CAVALCADE CONTAMINANT SURVEY

VOLUME I

ENGINEERING REPORT

CAMP DRESSER & McKEE INC.
IN ASSOCIATION WITH
McCLELLAND ENGINEERS, INC.

JULY 11, 1983

PREPARED FOR:

METROPOLITAN TRANSIT AUTHORITY OF HARRIS COUNTY

HOUSTON. TEXAS

SUBMITTED BY:

HOUSTON TRANSIT CONSULTANTS

AND

CAMP DRESSER & MCKEE INC.

CAVALCADE CONTAMINANT SURVEY

JULY 11. 1983

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environmental engineers, scientists
planners, & management consultants

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July 11, 1983

Houston Transit Consultants
2000 West loop South - 6th Floor
Houston
Texas 77027

Cavalcade Contaminant Survey

near Mr. Stankovsky:

Submitted herein are five copies of Volume 1 of our three-volume report. for the Cavalcade Contaminant Survey performed for the proposed METRO-Stage One. Regional Rail System (RRS). This draft report includes both Phase I and partial Phase 2 work as outlined by our proposals dated January 27. 1983 and May 23. 1983. This project was performed in accordance with our Contract/Work Authorization Numbers 08001-01-011 dated April 29, 1983 and .08001-01- dated

The Engineering Report summarizes the results of the field investigation program and of the remedial action alternatives analysis. Remedial actions for the Cavalcade Yard site as well as potentia; additional tasks to be completed are recommended in this report.

We appreciate the opportunity to be of service to you on the first two phases of this project and look forward to finalizing our work associatcd with this important project.

Very truly yours.

CAMP DRESSER & McKEE INC.

David F. Doyle, P.E.
Vice President

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CAVALCADE CONTAMINANT SURVEY

VOLUME I

ENGINEERING REPORT

METRO-STAGE ONE, REGIONAL RAIL SYSTEM

HOUSTON, TEXAS

" " "

Report

to

Houstor: Transit Consultants

Houston, Texas

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by

CAMP DRESSER & MCKEE INC.

Environmental Consultants
Boston, Hassachusetts
in association with
HcCLELLAND ENGINEERS, INC.
Geotechnical Consultants
Houston, Texas

July **11,** 1983

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TABLE OF CONTENTS
VOLUME 1

ILLUSTRATIONS

VOLUME I

1.0 PREFACE

The Cavalcade Contaminant Survey was undertaken by the project team of Camp Dresser & McKee Inc. (COM) and McClelland Engineers, Inc. (MEl). Camp Dresser &McKee provided technical and environmental services throughout both phases of the project. McClelland Engineers served as the geotechnical consultant and project administrator. This report is presented in three separate volumes: Volume I - Engineering Report, Appendix I - Health and Safety/Sampling and Analytical Plan, and Appendix II - Analytical Data. The key members of the project team are listed below:

MEMBER	ORGANIZATION	FUNCTION
David F. Doyle	CDM - Boston	Project Manager
Donald Muldoon	COM. Boston	Project Chemist/Health and Safety
Michael Hoggle	MEI - Houston	Projected Administrator
William Tobin	MEI - Houston	Project Engineer
Jeffrey Gram	COM - Boston	Field Scientist
Paul Williams	CDM - Boston	field Scientist
Robert Brandes	CDM - Austin	Regulatory liaison
Robert Kier	CDM - Austin	Project Geologist

This stUdy was conducted in cooperation with the Houston Transit Consultants (HTC) who provided information on the Cavalcade Yard and Shop facilities. The principal contacts within HTC on this study include Mr. Don Stankovsky and Dr. Cheng Ku.

2.0 SUMMARY

A contaminant survey was undertaken at the Cavalcade Yard site to determine the general extent of contamination present and to assess the suitability for its intended use as a maintenance yard and metro transit station. The results of the survey were used to formulate a Remedial Action Plan to secure the site and to limit long-term adverse environmental effects.

It was found that the proposed tavalcade Yard site contains localized areas of contamination from primarily wood preserving waste products. This study was not intended to provide a detailed, comprehensive evaluation of the site. The objective was to develop a general assessment of the environmerta1 qua Iity. Additiona I areas of contami nation may be present at locations not investigated during this study.

The field investigation program concentrated on an evaluation of the shallow soils to a depth of about 10 ft and the shallow groundwater aquifer underlying the site. Both the shallow soils and the aquifer were found to have been contaminated at localized areas. The field program also disclcsed some potential waste disposal areas that may require future removal.

A groundwater observation program was initiated to determine the direction of groundwater flow and the potential for off-site migration of contaminants. It was demonstrated that although the shallow sound aquifer extents Off-site, no detectable concentrations of contaminants were found to be leaving the site under the current hydrogeologic conditions.

A oeep observation well was installed to a depth of about 200 ft into the shallowest aquifer known to be currently used for domestic groundwater supplies which based upon available information was not contaminated. The purpose of the well was to determine if the surficial contaminants had migrated into known groundwater resources. Deeper off-site production wells were also sampled. It was demonstrated that there were no indications that wood preserving waste products had migrated from the site into the groundwater supplies.

Results of this study have not been completed. Work on the project was terminated during the course of the investigation. Additional work is required to complete the contamina1t survey. Recommendations are given on the remaining tasks to be completed.

Remedial action alternatives were evaluated with respect to mitigating adverse environmental effects due to contaminated water encountered during construction activities and the contaminated source materials. The recommendations are included in this report.

3.0 INTRODUCTION

3.1 General

Houston Transit Consultants (HTC), under a contract to the Metropolitan Iransit Authority of harris County (Metro), is currently engaged in a preliminary design study for transit development within Harris CQunty, Texas. The proposed METRO-Stage One, Regional Rail System consists of three segments (1) West Corridor - Wilcrest to Webster, (2) Central Business District - Webster to Interstate 10, and (3) North Corridor - Interstate 10 to Crosstimoers. There are 17 stations'located at approximately one-mile intervals along the 18.2 mile alignment. A maintenance and storage facility is also planned near Cavalcade Street along the North Corridor. Plate 3-1 shows the general alignment of the proposed METRO-Stage One. Regional Rail System.

3.2 Cavalcade Yaroand Shop

The proposeo Cavalcade Yard is located in north Houston between the existing Houston Belt and Terminal (HB&T) Railroad Passenger Main on the west border and the HB&T Railroad Freight Main on the east border, near the 2000 block of Cavalcade Street. ,Jhe site vicinity map is shown on Plate 3-2. Originally, the facility was to extend about one-half mile north of Cavalcade to Interstate 610 and about one-half mile south of Cavaicade to the north property line of Merchants Fast Motor lines. The proposed site location was subsequently moved to the south, but is still bordered on the east and west by HBST Railroad. The current north border coincides with Cavalcade Street and the south border coincides with Collingsworth Street. Plates 3-3 and 3-4 respectively show the original and current facility layouts.

The proposed Cavalcade Yard and Shop includes a variety of facilities inclUding provlsions for future facilities. A list of the planned structures includes:

(a) a two-story operations and maintenance of way facility with an inspection pit;

(b) a two-story vehicle maintenance shop consisting of rail car service bays, several inspection pits, loading dock, and a traction power SUbstation;

(c) proposed and future trackage;

(d) a car washer facility with sump pits;

(e) access roads with paved parking areas;

(f) materials storage areas;

(g) a yard tower;

(h) a retention area; and

(i) a microwave tower.

In addition, the Cavalcade Station is to be located north of Cavalcade Street. bordering on the west side of Maury Road. The Cavalcade Station will be connected by an underground pedestrian tunnel serving the parking area west of Maury Road.

3.3 Reconnaissance Study

During December 19B2, McClelland Engineers performed a reconnaissance geotechnical stUdy for the proposed Cavalcade Yard site, before the site was relocated. McClelland Er,lneers Report Number 0182-0282, Volume VII, dated May 20, 19B3, included gereral soil conditions and preliminary foundation recommendations for the current facility layout.

During the investigation, creosote odors were detected by the field investigators at some of the boring locations. Several soil and groundwater sanlples were collected and Subsequently analy2ed for naphthalene and phenanthrene - indicator COmpOunds of creosote. Results of the tests are included in Appendix II - Analytical Data. Based on the test results and review of available aerial photographs, it was determined that the Cavalcade Yard site was potentially contaminated with creosote wastes from wood preserving and treating operations formally conducted at the site. On December 29, 1982, recommendations were made that an additional investigatlon be performed to assess the extent of the contamination proolem and its potential impact on development of the site.

3.4 Project Approach

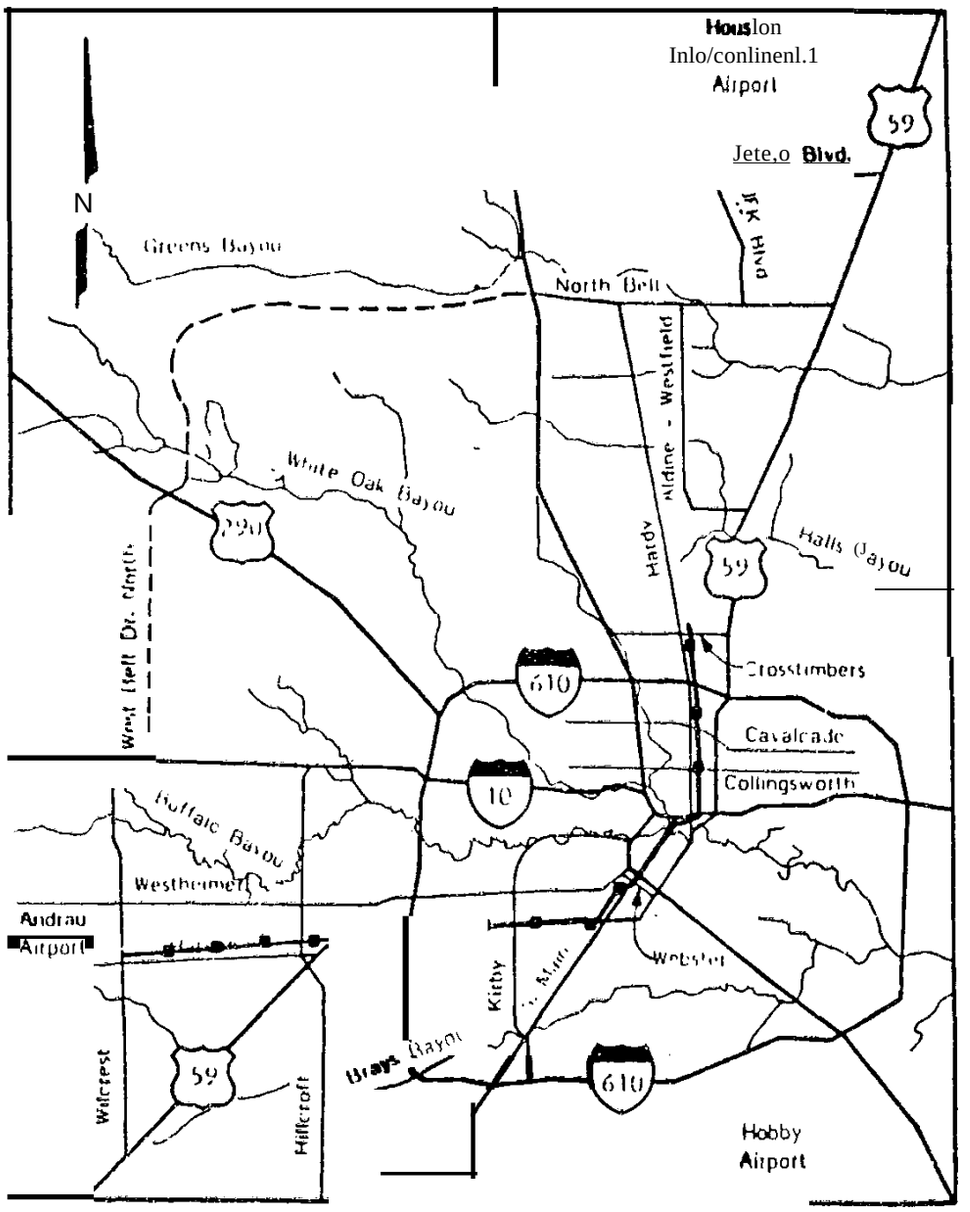
The Cavalcade Contaminant Survey was organi2ed into three major phases. Phase 1 included a general site reconnaissance based on the original facility layout with the objective of identifying potentially ha2ardous wastes at selected locations throuQhout the site. Phase 2 consisted of a detailed investigatiof. to determine the hydrogeologic characteristics of the site and to identify additional contamination in ti,e areas of the proposed structures. Phase 2 work occurred after the 'acility layout was revised. Phase 3 was to inclUde construction supervision and on-Site monitoring during the remeOial program. This last phase will be completed at a later date.

This report includes the work performed under Phase 1 and Phase 2. During the course of the Phase 2 fleld investigation. all work was terminater In the Regional Rail System and we were therefore instructed to terminat. the study. The actual scope of work completed is described in more detail in Section 6. Recommended future investigations are given in Section 9.

3.5 Report format

The results of this study are submitted in a three-volume report: Volume I - Engineering Report, Appendix I - Health and Safety/Sampling and Analytical Plan, and Appendix II - Analytical Data. Volume I includes pertinent descriptions of the historical review. field investigation, an

environmental site evaluation, and the proposed remedial action plan. Preliminary remedial recommendations have been included based on interpre. tation of the analytical data, TDWR requirements, and anticipated construction. A more detailed and thorough report on the sampling and analytical procedures and health and safety aspects has been incorporated into a second volume for clarity. Appendix II contains results of all of the analytical tests performed.



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Proposed alignment of MITRO-Stage One, RRS

• Proposed passenger stations
(CBD stations nol shown\

RAIL ALIGNMENT MAP

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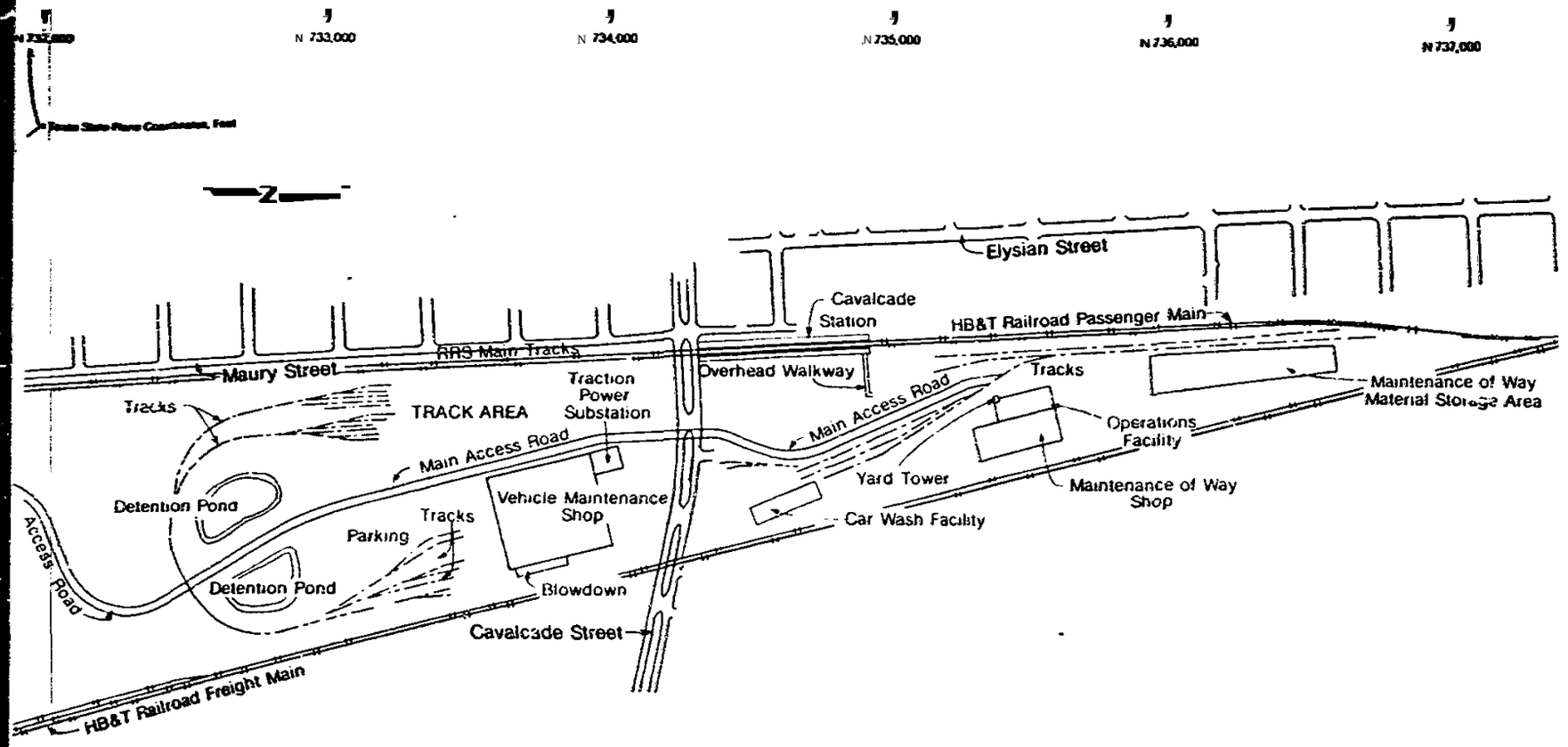

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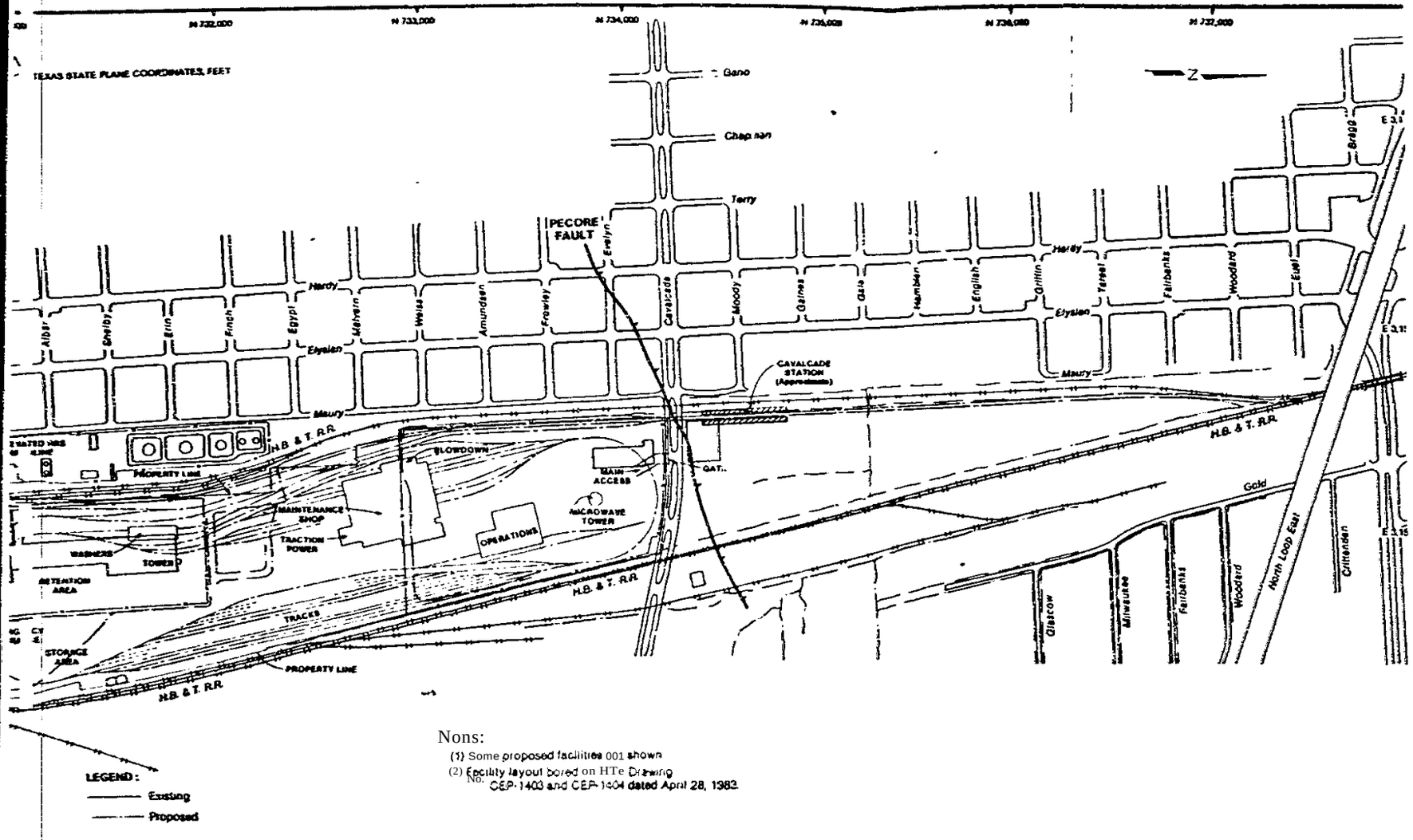

Nons:

(1) Some proposed facilities 001 shown

(2) Facility layout bored on HTe Drawing No. CEP-1403 and CEP-1404 dated April 28, 1982.

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4.0 HISTORICAL REVIEW

The historical review of the Cavalcade Yard site was divided into three parts: deed research, interviews, and aerial photographs. The objective of this review was to identify where wood preserving activities were previously located at the proposed site and to determine where their wastes might have been disposed. The purpose of this review was to obtain information to assist in strategically locating a limited number of samples to assess the general extent of contamination.

This historical review focused on a 63-acre tract of land that is generally triangular in shape. This study tract is bounded on the 'south by Collingsworth Street. on the east by the Missouri Pacific Railroad, on the west by Maury Road, and on the north by Interstate 610.

4.1 Deed Research

houston Transit Consultants (HTC) furnished a copy of the deed which transferred ownership of the Koppers property on Collingsworth to Merchants Fast Motor LInes in 1962. This deed made mention of other recorded deeds giving volume, page number, and year. With this deed as a starting point, a search was undertaken to uncover past ownership and land use of the study tract.

The southern portion of the study tract has had a history of land use involving WOOd treating operations prior to those of Koppers Company, Inc. National Lumber and Creosoting Company acquired ownership of part of the study tract along Collingsworth Street in 1911. They apparently were in operation at this site until 193B when they became a subsidiary of the Wood Preserving Corporation. Then, the Koppers Company acquired ownership in 1940 and remained in operation there until 1962.

lhe limited deed research did not disclose any information pertaining to wood treating operations north of present.day Cavalcade Street. The cIty directories were also checked, however, no records of creosoting operations were discovered.

4.2 Interviews

Interviews were conducted with Koppers Company personnel, adjacent and or-site property owners. and local residents. Conversations with representatives from the Koppers Company indicate that they operated two facil. ities located adjacent to Collingsworth Street. Their wood preserving operations areas were primarily located at the present-day office of Merchants Fast Motor lines. Product storage areas were located to the back or north end of their property. A second Koppers operation, their Coal Tar Products Division, was located adjacent to the east side of the wood preserving operations. This site roughly corresponds to the present-day location of Palletized lrucking Inc. It is believed that the Coal Tar Products Uivision processed various wood preserving compounds including creosote and pentach1oropheno1 (PCP).

Some information was obtained indicating that wood treating and preserving operations were conducted by another company north of Cavalcade Street. As previously mentioned, this information was not verified from the deed research. According to koppers representatives, a smaller operation was situated just north of present-day Cavalcade Street. This operation presumably involved a dipping process whereby lumber was treated by placing into an open vat or pit containing unknown preserving compounds. This operation was verified by an interview with a former employee who worked there during the 1950s.

Aaaitional interviews with nearby property owners and residents indicate that smaller-scale creosoting operations were common practices with the railroads. A few residents stated that"these type of activities took place along the HBSl Railroad Freight Main bordering the east property line, north of Cavalcade Street. Representatives of H1C also indicate that both railroad mains were built ill the late 1800s.

4.3 Aerial rhotographs

A review of available aerial photographs was undertaken to supplement and ver'fy information from the deed research and interviews.)nterRretation of this materia1 wa si nstrumenta1 in identifying potential areas of suspected wood treating activities and in developing a preliminary sampling program. Several aerial photographs were obtained for the study inclUding coverage for the years of 1944, 1953, 1957, 1964, 1966, 1972, and 1973. lhe primary source of photographs was the U.S. Department of Agriculture in Salt Lake City, Utah. 1hese photographs were enlarged to a scale of 1 in• • 400 ft. lwo private sources were also obtained, landis Aerial Surveys for the 1966 photographs and Wilson/Baldwin Aerial Surveys for the 1972 photographs. lhese photographs were reproduced to a scale of about) in•• 1000 ft.

1944 Photograph. lhe 1944 aerial photograph revealed that the Koppers Company operations were limited to the southern end of the study tract. 1heir main treatment and processing areas appear to be"ocated adjacent to Collingsworth Street, bordered on the east and west by the railroad mains. Most 01 the material storage areas were located towards the back of the property or north of the operations areas. The total area of activity occupied approximately 46 acres. The northern most extent of activity was about 500 ft south of present-day Cavalcade Street. An undeveloped triangular-shaped area of approximately 19 acres was located at the northwest corner of the tract south of Cavalcade Street. No activity was observed in the tract north of Cavalcade Street. Large trees and dense vegetation are evidence that these undisturbed areas had been vacant for several years.

1953 Photograph. The 1953 aerial photograph revealed some significant changes since 1944. The operations areas were still located at the south end of the tract, with the main storage areas located to the north. The Mobil Oil Company was shown to occupy about 10 acres along the east border of the stUdy tract, extending to Collingsworth Street. The northern most extent of activity was still about 500 ft south of present-day Cavalcade Street. lhe undeveloped area south of Cavalcade was similar to the one shown in the 1944 aerial photcgraph.

The areas of most significant change in 1953 were located north of Cavalcade Street. This north tract is about 9 acres in Size. Most of the vegetation was removed throughout the entire north tract. Several areas of activity were present at the southern end of the north tract and along the railroad bordering on the east. In general. most of the operations areas tend to be situated along *the* south border and the materfals storage areas tend to be located along the east border. Several areas of disturbance, as *noted* by light and dark contrasting ground colors, were noted adjacent to the materials storage areas. These disturbed areas may represent waste disposal areas from the wood preserving operations.

1957 Photograph. The 1957 aerial photograph showed some additional features. The major activity areas in the south tract (south of present-day Cavalcade Street) were generally situated in the same locations as shown by the 1944 and 1953 photographs. However, a dark-colored, rectangular shaped feature was located in the undeveloped area about 900 ft south of present-day Cavalcade Street. This feature was approximately IOO-ft wide and 150-ft long and had the appearance of being man-made. The contrasting dark color may represent standing surface water (i.e., pond or pool) or foreign materials. In addition, a light-colored, circu1ar-sllaped feature was located about 50 ft east of the suspected pond. This second feature was approximately 60 ft in diameter and may represent an area where the soil was excavated or where foreign materials were placed. Both of these features are suspected of being disposal areas for the wood preserving operations.

The activity areas in the north tract were somewhat more pronounced indicating increased activities from 1953 to 1957. Additional roads and increased storage areas were observed. The general locations of the suspected wood treating activities in the north tract remained north of present-day Cavalcade Street•

1964 Photograph. lhe 1964 aerial photograph showed changes primarily in the south tract after the Koppers operations were closed and moved to a site near Hardy Road and Crosstimbers Street. The two suspected disposal areas identifed in the 1957 photograph were still present in 1964. A trucking company (presumably Merchants Fast Motor lines) occupied the Koppers operations yard at the south end of the tract. Approximately 7.5 acres in the southern section of the tract were paved by the trucking lines. The northwest section of the tract was still undeveloped. Some industrial activity was also present at the southeast portion of the site. lhis activity is probably the resu1' . another trucking company developing the site. This area also coincides with the present-day location of Palletized Trucking.

A decrease in activity in the north tract was observed. The materials storage areas in the north tract were not present. However, a new feature was observed. A triangular-shaped, dark-colored structure was identified at the former operations area. This feature was particularly suspicious because of its proximity to the suspected wood preserving operations areas and because its dark contrasting color suggests it may contain liquids or standing surface water.

1966 Photograph. The 1966 aerial photograph was almost identical to the 1964 photograph. No significant changes were observed in the north tract. One additional feature was identified in the south tract near present-day Cavalcade Street. This dark-colored, rectangular shaped area was approximately 50-ft wide and 200-ft long and was located near the two suspected disposal areas first identifed in the 1957 aerial photograph. It is believed that this feature may not be related to any on-site disposal practices on the south tract because no wood treating activities were observed after 1962. This feature may represent a low lying area subject to isolated flooding.

1972 and 1973 Photographs. The 1972 and 1973 aerial photographs show some additional commercial development. Cavalcade Street now extends between tne north and south tracts. Another trucking company (presumably Transcon Trucking lines) is located on the south side of Cavalcade and Occupies part of the undeveloped portion of the site 1dentified in previous aerial photographs. An additional building was constructed on the north side of Cavalcade Street near the area where the triangular-shaped, dark-colored feature was identifed in the 1964 aerial photograph. Little evidence of previous wood treatlng activities was observed in the south tract. A 14.5 acre fleld separated the two trucking companies and occupied roughly tne midole one-third of the south tract.

4.4 SIte Reconnaissance

Representatives from McClelland Engineers and Camp Dresser & McKee visited the site on January 25, 1983. The purposes of this reconnaissance were to observe evidence of past wood preserving activities and to check fOr indlcatIOnS of surficial contamination.

Approximately the middle one-third of the site is vacant and has apparently remained undeveloped since Koppers moved in 1962. The current owner of this parcel is Merchants Fast Motor lines which was formerly Meridian Transport Company. Some evidence of previous wood preserving activities was observed in this vacant tract. Most of the access roads and materials storage areas'are overgrown with vegetation. However, there are several small areas where abandoned treated cross ties and rubble have been piled. These areas are primarily scattered along the south and east borders of the vacant tract. Most of the area north of Cavalcade Street where previous wood preserving operations were located has been filled.

Some minor evidence of surficial contamination was also observed. Visual inspec'tion of the site drainage ditches disclosed some areas at the south end of the site with contrasting black-colored sediments. The drainage d1tch located along the southeast border of the site, parallel to the railroad tracks, was visibly stained with dark-colored petroleum products. An oil slick was also present in areas where the ditch contained standing water. Oil spillage was noted about 100 to 200 ft west of the ditch, at Palletized Trucking Inc. In addition, a lime sludge disposal facility is currently located adjacent to railroad tracts on the east border of the site. This facility contains random piles of lime sludges Ind open ponds covering over 3 acres. Because the waste materials have encroached off of the property, the Texas Department of Water Resources (TOWR) has taken

action against the owner. This disposal area was also present on all of the aerial photographs studied subsequent to 1944.

4.5 Area land Use

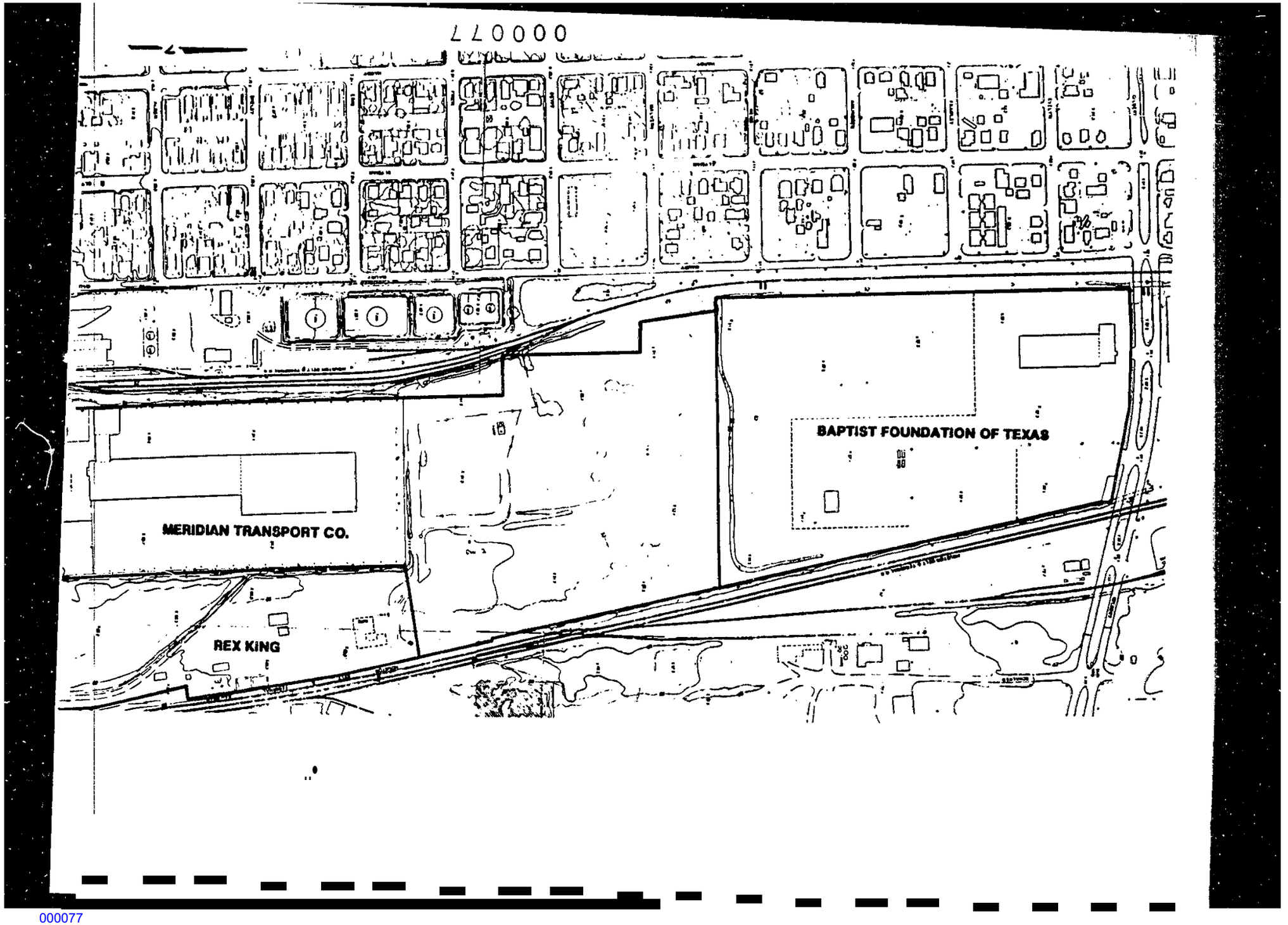
The present day land use of the proposed Cavalcade Yard site is predominantly commerCial. Merchants fast Motor lines and Palletized Trucking Inc., are trucking companies presently operating at the south portion of the site adjacent to Collingsworth Street. Transcon Trucking Lines is another trucking COmpany presently operating at the north portion of the sIte adjacent to Cavalcade Street. An open field with no land development is situated between the two trucking companies and occupies approximately the middle one-third of the tract. Plate 4-1 shows the current property owners for the present site locatIon. Plate 4-2 shows the current property owners for the original site location.

The areas surrounding the site are mixed residential, commercial, and industrial. Old. established. low-income neighborhood areas surround the general site area. The closest residential area is located on Maury Road and borders along the west property line. Commercial businesses are primarily located along the major roadways inclUding Cavalcade Street. Jensen Drive, Collingsworth Street, and State Route 59.

loe immediate area of the site has had a history of industrial development. Served by two major rail lines since the late 1800s, this location has supported a variety of 'rdustries. The following list includes known industrIeS that once operated or currently operatIng in the area.

1. Rendering Plants
2. liquid Fertilizer Company-
3. Chemical Companies-
4. Metal Processing Plants·
5. Metal Recycling Plants·
6. liquid feed Plant-
7. Wood Treating and Preserving Facilities
8. Cotton Seed Oil Plant
9. Industrial Gas Manufacturing Plant*
10. Metal Castings Plants-

Industries marked with an asterisk (*) denote firms that are known to be currently operating in the site area.


BAPTIST FOUNDATION OF TEXAS
MERIDIAN TRANSPORT CO.
REX KING

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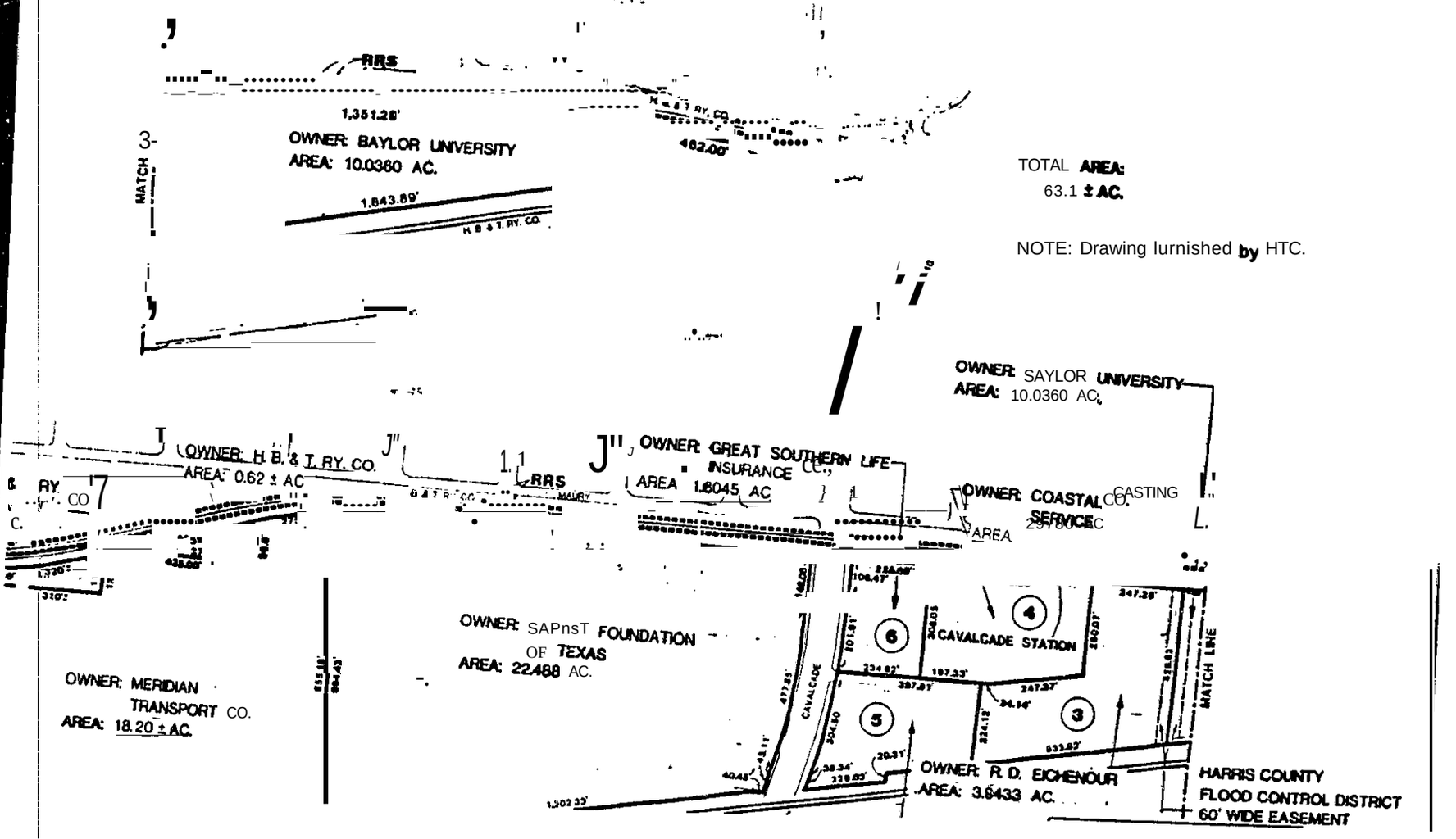
CAVALCADE YARD & SHOP FACILITY



TOTAL AREA:
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NOTE: Drawing lurnished by HTC.

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5.0 SITE CONDITIONS

This section describes the general conditions at the proposed Cavalcade Yard site. Information was obtained from previous studies conducted by McClelland Engineers and published references. The general site conditions form the basis of the findings and recommendations presented in subsequent sections.

5.1 Site Description

The proposed Cavalcade Yard site is located in north Houston as Shown on Plate 3-1. The site covers an area of approximately 66 acres and is bounded between the Houston Belt and Terminal (HBST) Railroad Passenger Main and Freight Main. Originally, the Cavalcade Yard location was to extend north to Interstate 610 but was subsequently shifted south. The current north and south boundaries are Cavalcade and Collingsworth Streets.

The proposed site is partially developed. Transcon Trucking Lines occupies roughly the no-thern one-third of the tract. Merchants Fast Motor Lines and Palletized Trucking occupy roughly the southern one-third of the tract. The remaining middle one-third is undeveloped and consists of an open field and several small wooded areas.

5.2 5011 Conditions

5011 condltions at the original site location were previously investigated durlng the course of the Reconnaissance Study for the Cavalcade Yard (see McClelland Engineers Report No. 0182-0282. Volume VII. dated May 20, 1983). Flfteen soil borings were drilled to depthS ranging from 15 to 80 ft. Plate 5-1 presents the locations of these borings relative to the current facl1ity layout. No borings were drilled at the southern portion of the current site location because of site access problems. Plates 5-2a and 5-2b show a generalized soil profile depicting the soil conditions throughout the site based on the reconnaissance borings. A legend to the terms and symbols used on the generalized soiI profiles is shown on Plate 5-3.

The soil borings made during the Reconnaissance Study for the Cavalcade Yard generally disclosed four distinct soil strata. Although there are some variations in strata elevation and thickness, the following generalized soil strata appear to be continuous throughout the site.

Stratum	Depth, ft	Oescription
I	0 - 2	fi1\: Silty fine SAND
II	2 - 10	Soft to very stiff sandy CLAY and clayey SAND
]II	10 - 20	Medium dense to very dense fine SAND
IV	20 - 80	Very stiff to hard CLAY and silty CLAY with sand and silt layers

Stratum III consists of a shallow sand layer, typically located about 10 ft below ground *Surface*. The thickness of the shallow sand layer varies across the site from about 5 to 10 ft. Based on the reconnaissance borings, the shallow sand layer appears to be present throughout the site. *In* addition, soil borings along Cavalcade Street *(refer* to section 6.2) indicate the shallow sand layer extends off-site. Plate 5-4 presents the interpretation of the regional extent of the shallow sand layer .in the area of the site. This illustration was prepared from information obtained from the Historical StUdy, Peconnaissance Study, Cavalcade borings, and Texas Department of Highway borings. The exact location of this sand layer was not identified and may therefore extend beyond the boundaries shown on Plate 5-4. The unshaded area shown on Plate 5-4 represents the portion of the shallow sand layer believed to extend west from Irvington Street, but not confirmed from the soil borings.

Typical sand layers common to the Texas Gulf Coast area usually contain various amounts of SIlt. As a result, permeability estimates of coarse-grained deposits will largely depend upon the silt content. Based on experience with similar soils, the estimated permeability of the shallow sand is approximately 10 -- cruls.pc. This value can vary by several orders of magnitude and should therefore be used only as an approximate value.

Four soil borings were previously located near the southern portion of the current site location as shown *on* Plate Sol. Three of these borings (RN-10, RN-11 *and* RN-12) were drilled during the Reconnaissance Study fDr the North Corridor and were presented in McClelland Engineers Report No. 0182-0282, Volume VI, dated May 10, 1983. These borings are designated with an "RN' prefix. The additional soil boring located near the southern portion of the site (N-5) was inclUded *in* the Historical Data Study for Wilcrest to Intercontinental Airport. This boring is labeled with an "N' prefix and was presented in McClel)and Engineers Report No. 0181-0546, Volume I, dated May 27, 1982. The information from the four previous soil borings indicates that the general subsurface conditions near the southern portion of the site are similar to those disclosed throughout the remainder of the tract. However, additional boring information is required to verify the actual subsurface conditions.

The interpretation of the general subsurface conditions is based on soil and groundwater conditions observed only at the boring locations. This information has *been* USed as the basis for subsequent analyses and recommendations. Soil *and* groundwater conditions may differ at locations not investigated by borings. Additional soil borings are required to investigate the subsurface conditions at the sl'uthern portion of the site. If variations in subsurface conditions are disclosed by future investigations or during construction, a reevaluation of the recommendations may be necessary.

5.3 Regional Hydrogeology

The geologic strata underlying the Cavalcade Yard site consist principally of interbedded sands. silts, and clays of the Beaumont Formation. As shown on Plate 5-5, these sediments were deposited in fluvial (river) and deltaic environments during the Pleistocene Epoch. Clay and silt soils predominate in the upper 200 to 300 ft Of the Beaumont Formation. layers of sand

frequently occur as thin. discontinuous deposits of rather limited extent. Thicker, more continuous sand deposits Occur in the deeper parts of the Beaumont Formation and in the upper parts of the underlying lissie Formation. However. based on published geologic reports. the lissie Formation outcrops several miles north of the site area.

The lissie Formation and the lower Beaumont Formation are commonly used sources of groundwater supplies in the Houston area, althDugh their yields are generally considered two small for major exploitation. The deeper sands from the Chicot and Evangeline Aquifers, located over 1000 feet deep. are high yield aquifers used for major groundwater supplies.

The strata of the Beaumont Formation generally dip to the southeast towards the Gulf of Mexico. Thus, the sediments exposed at the surface become progressively younger toward the coast. The regional dip of the strata and the presence of the interbedding of the sands and clays result in considerable influence on the regional hydrogeology of the Houston area. Based on published geologic literature, the principal areas of groundwater recharge fer the Chicot and Evangeline Aquifers (i.e.• lissie Formation) occur several miles north of the site area.

The predominance of clay and silt soils in the upper part of the Beaumont Formation and the southeastward dip of the geologic strata serve to act as a confining layer for the Chicot Aquifer. This produces artesian groundwater conditions in theChicot Aquifer. The limited sand layers in the upper Beaumont Formation are considered too discontinuous to allow effectIve recharge to the deeper aquifers.

5.4 Surface Drainage Features

SIte surface drainage consists of two main features. The developed areas occupied by the trucking companies contain a system of ditches. storm water inlets and catch basins to convey runoff into the storm sewer system. The unaeveloped portion of the site is poorly drained. Ditches are mainly located along the east and west property borders and parallel to the railroad lines. No significant drainage features are present throughout the interior of the undeveloped tract. Generalized drainage flow paths are shown on Plate 6-1. The ground surface elevation throughout the site is about (1 52. The average ground surface slope is less than 0.1 percent.

Plates 5-6 and 5-7 show the general ground surface contours in the site area for the years of 1922 and 1967. respectively. Both plates show that the site slopes very gently to the southeast.

Little White Oak Bayou provides regional drainage to the west of the site and Hunting Bayou provides drainage to the east of the site. Plate 5-4 shows the approximate location of these two bayous. It can also be seen that the shallow sand layer present at the site appears to intersect both bayous. However. a hydraulic connection between the sand layer and the bayous has not yet been established.

Little White Oak Bayou trends along a general north-south direction about one mile west of the site. Little White Oak Bayou drains south to White Oak Bayou which empties into Buffalo Bayou. Hunting Bayou trends in a

general east-west direction and is located about one-half mile east of the site. Both Buffalo Bayou and Hunting Bayou flow directly into the Houston Ship Channel.

5.5 Production Water Wells

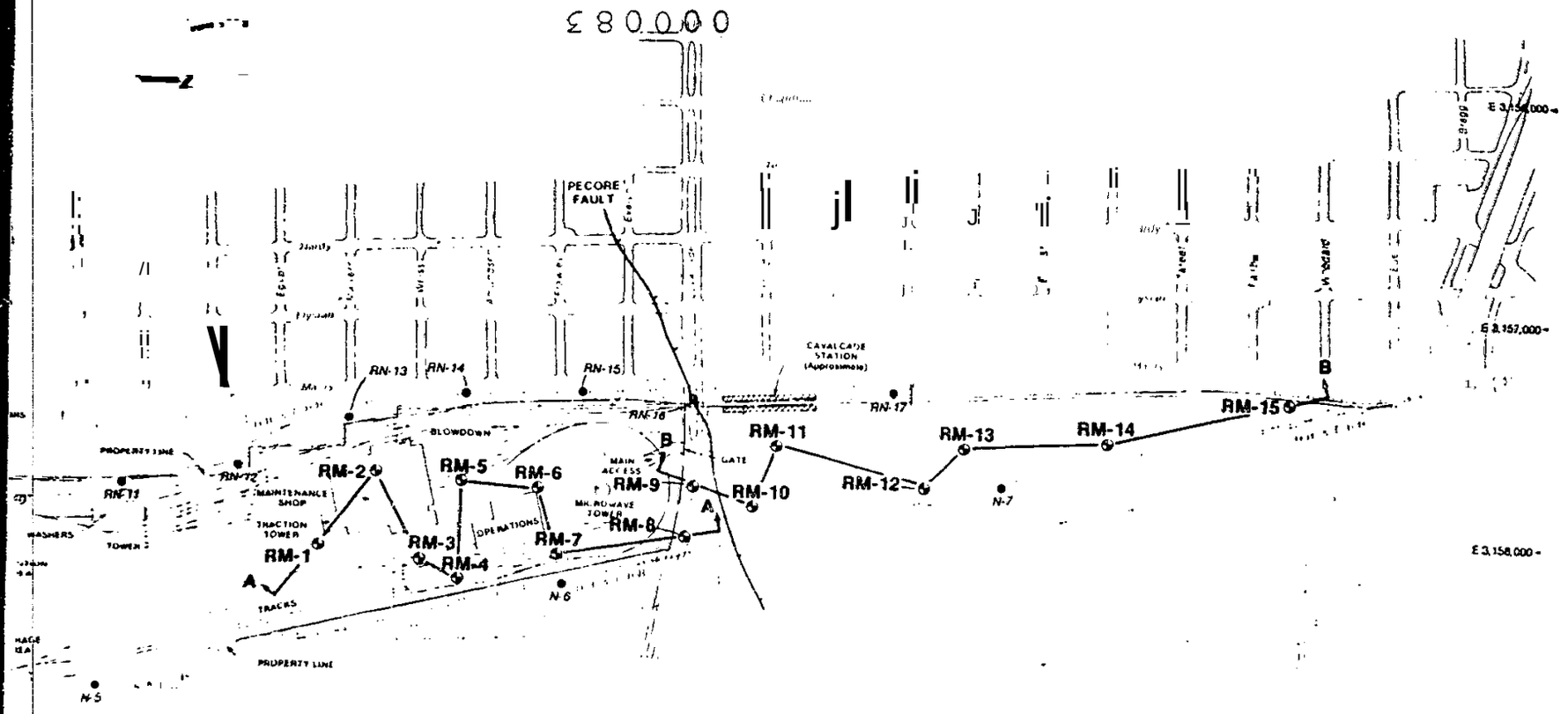
An inventory of water wells located in the site vicinity was conducted to identify the locations of potential groundwater supplies. Several agencies were contacted for information including the United States Geologic Survey • Texas Department of Water Resources, and the Harris-Galveston Coastal Subsidence District. Several wells were located within a two-mile radius of the site. Plate 5-8 shows the approximate locations of water wells still in operation. It should be noted that many of the records published by the agencies were found to be outdated and incomplete. Additional wells may exist near the site that do not appear on Plate 5-8.

Three common strata used for groundwater supplies in the site area were identified. The uppermost aquifer is located about 170 to 220 ft below ground surface. This formation does not have a high yield and is therefore restricted to primarily domestic use. The second aquifer is located approximately at depths of 450 to 600 ft. This aquifer is used mostly for inaustrial purposes. The third aquifer is located typically below 1000 ft and is used primarily as a drinking water supply for the City of Houston.

5.6 Surface Faults

The Pecore Fault is the only known mapped active fault in the vicinity of the Cavalcade Yard site. The fault trends approximately east-west and intersects the land surface just north of Cavalcade Street. The approximate location of the Pecore Fault in the site vicinity is shown on Plate 5-9. The fault location is also shown on Plate 6-1 relative to the proposed facility layout. Information pertaining to the fault location was obtained from McClelland Engineers Report Number 0181-0546-2, dated September 3D, 1982. The predicted annual differential movements across the fault were about 0.4 inches vertical and 0.1 inches horizontal.

Generally. faults in the Houston area serve as partial hydrogeologic barriers for groundwater movement. Permeable strata may be partially offset by relatively impermeable strata. Thus, isolated portions of the groundwater aquifer may nave differing hydrogeologic characteristics due to active fault movements. The extensive withdrawal of groundwater and petroleum supplies in the greater Houston area and resulting land subsidence has resulted in accelerated fault movements during the past 40 to 50 years.



NOTES:

(1) Some proposed facilities are not shown

(2) Borings labeled "RM" were performed for our report to Houston Transit Consultants entitled "Geotechnical Data Report, Reconnaissance Study, North Corridor, METRO - Stage One, RRS (Vol V)," dated May 6, 1983 (our Report No. 0182-0282)

(3) Borings labeled "N" were presented in our report to Houston Transit Consultants entitled "Geotechnical Data Report, Historical Data Study, Wilcrest to Intercontinental Airport (Vol I)," dated May 27, 1982 (our Report No. 0181-0546).

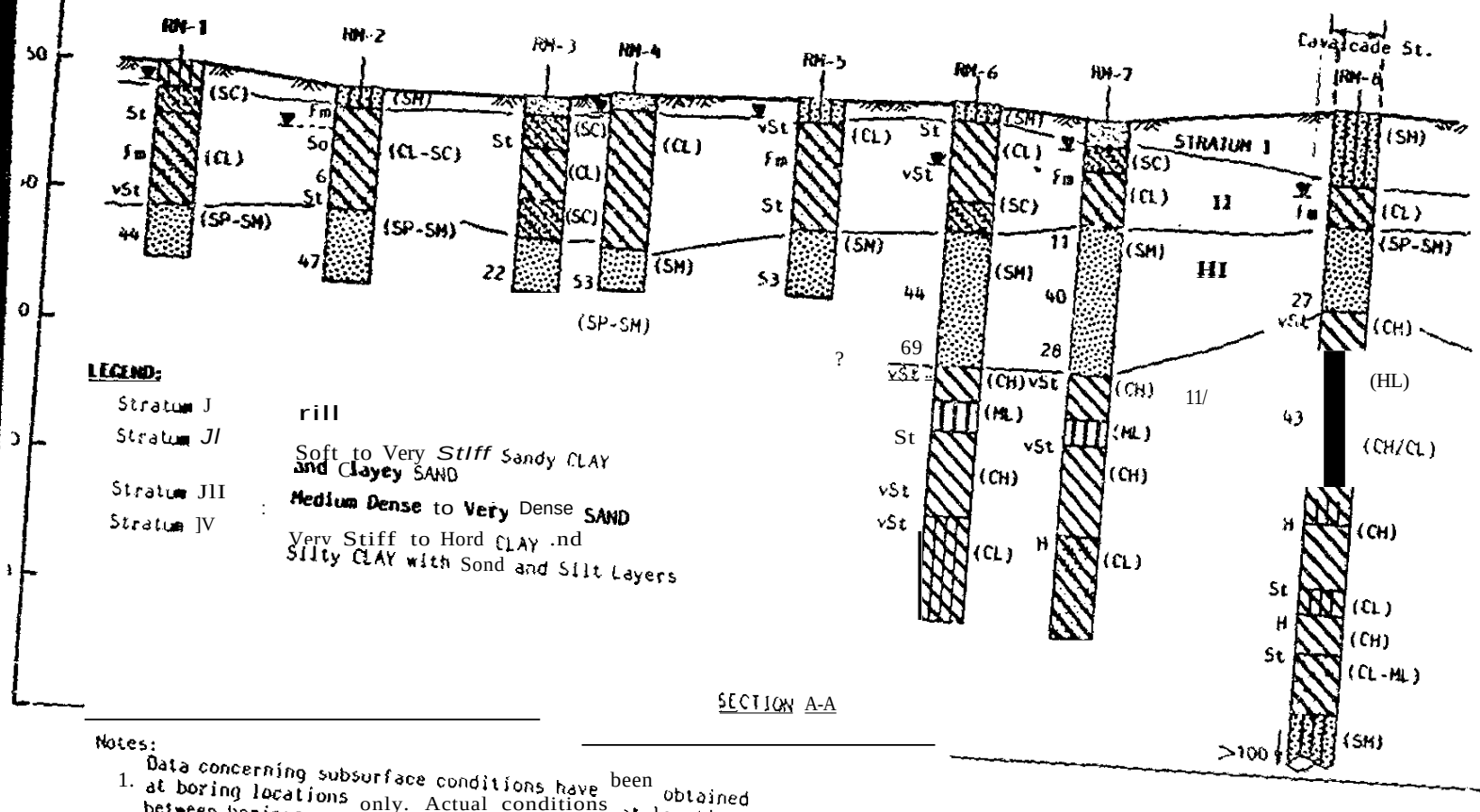
LEGEND:

- Existing
- Proposed
- Boring (this study)
- Boring (previous study)
- Drainage Swale

0 500

1000 Feet

McClelland engineers



SECTION A-A

LEGEND:

Stratum J — rill

Stratum JI — Soft to Very Stiff Sandy CLAY and Clayey SAND

Stratum JII — Medium Dense to Very Dense SAND

Stratum JV — Very Stiff to Hord CLAY and Silty CLAY with Sond and Silt Layers

Notes:

1. Data concerning subsurface conditions have been obtained at boring locations only. Actual conditions at locations between borings may differ from the generalized profile shown here.
2. See Plate S-3 for key to symbols and terms.

McClelland engineers

METRO-STAGE ONE. RRS
RECONNAISSANCE STUDY
CAVALCADE YARD AND SHOP

Some soil borings not sampled 6-2

4ft deep 3 borings
15' deep 13 borings

12 shallow observation wells 6-3

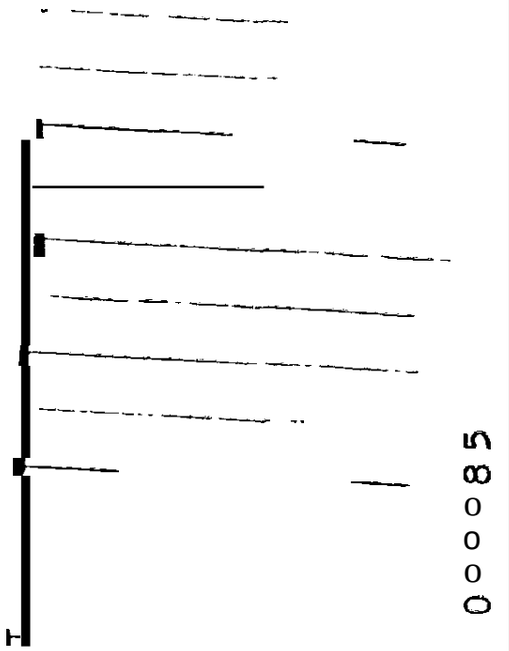
3 aquifer wells in area

3 off site wells sampled 6-7

Chain of custody used for soil samples

Shallow soil limited to suspected contaminated area 6-12

6-15



I;

6-18 missing

2 wells

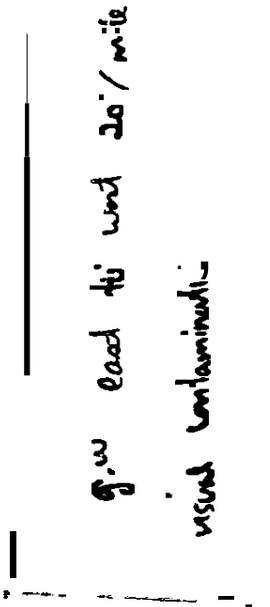
Shallow G.W. sampling for G.W. 4

contours & mean known contamination 6-19

5 wells sampled

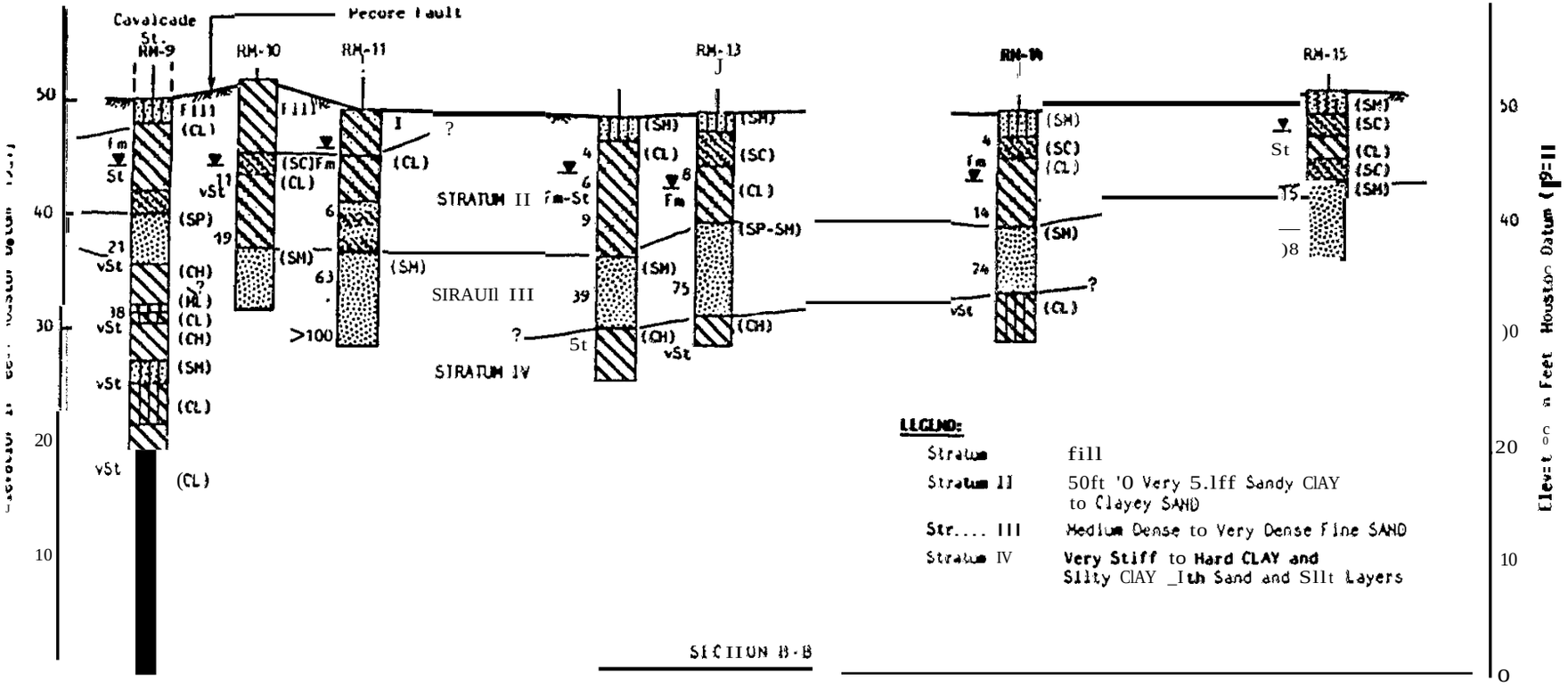
deep well sampled twice 6-22

Clays ≥ 200' show As, Cr, Pb



;

980000



SECTION B-B

Notes:

1. Data concernIng subsurface conditions have been obtai..ed at boring locations only. Actual conditions at locations between borings may dUrer from the generalized profile shown here.
2. See Plate 5-3 for key to symbols and terms.

DMJM engineers

METRO-STAGE ONE RRS
RECONNAISSANCE STUDY
CAVALCADE YARD AND SHOP

000086

LEGEND FOR SOILS PROFILE

CONDITION

COHESIVE SOILS

vSo	very soli
So	sofl
Fin	firm
Sl	51,11
vSl	very stiff
H	hard

COHESIONLESS SOILS

La	loose
mOe	medium dense
De	dense

COLOR

81	blue
Bk	blOCk
Br	brown
0	dark gray
G	gray
Gr	green
L	light gray
R	red
T	tan
Y	yellow
W	white

MATERIAL

cl	Cloy. cloyey
so	sand. sandy
S,	••11, silty
O'OV	gravel, gravelly
sh	sho'e. shaley
$0·$	son dstone
$i·$	silistone
ls	limestone
lig	lignite, lignitic

MODIFICATIONS

c	coorse
calc	calcareous
f	fone
fe	ferruginous
fts	fissured
•n b	inlerbedded
inm	intermixed
10m	lominoted
m	medium
nod	nodules
org	organic
pk!s	pockets
sm, sms	seam, seams
sl	slightly
$ls	sliCkenSided
slks	Sl-eok,
v	very
w/	wi·n

SYMBOLS

cloy

Sandy clay

silty clay

sand

clayey sand

Silty sand

water level

s,It

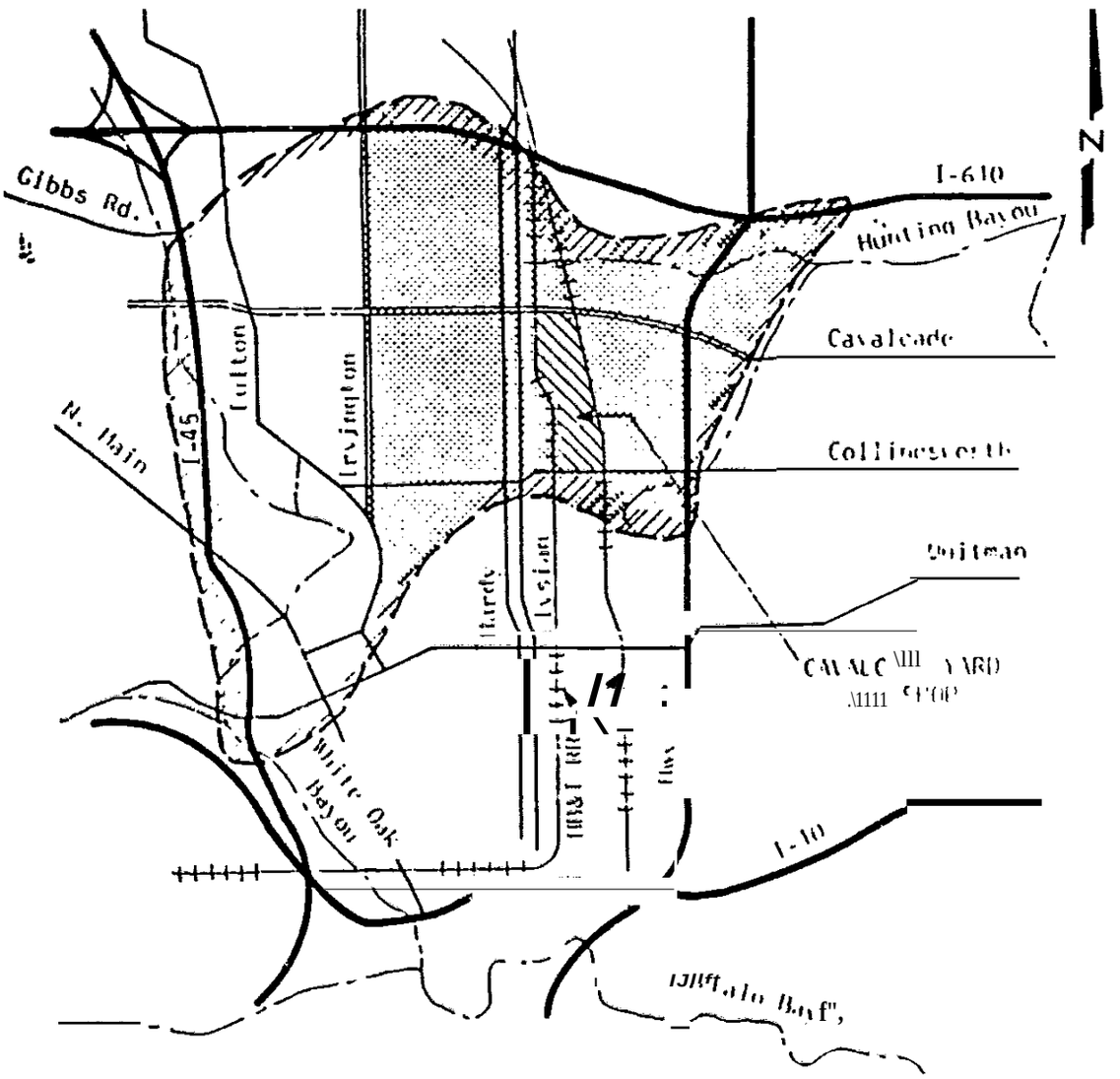
Clayey silt

,an·dy , ,It

PLATE 5·3

000087

000087



Note:
Shaded area indicates known areal extent of shatlow sand layer, as determined through exploratory borings. Dashed 1ine represents interp"lated shallow sand laVer area.

SHALLOW SAND LAYER LOCATION MAP

0 0.5 1 Mile

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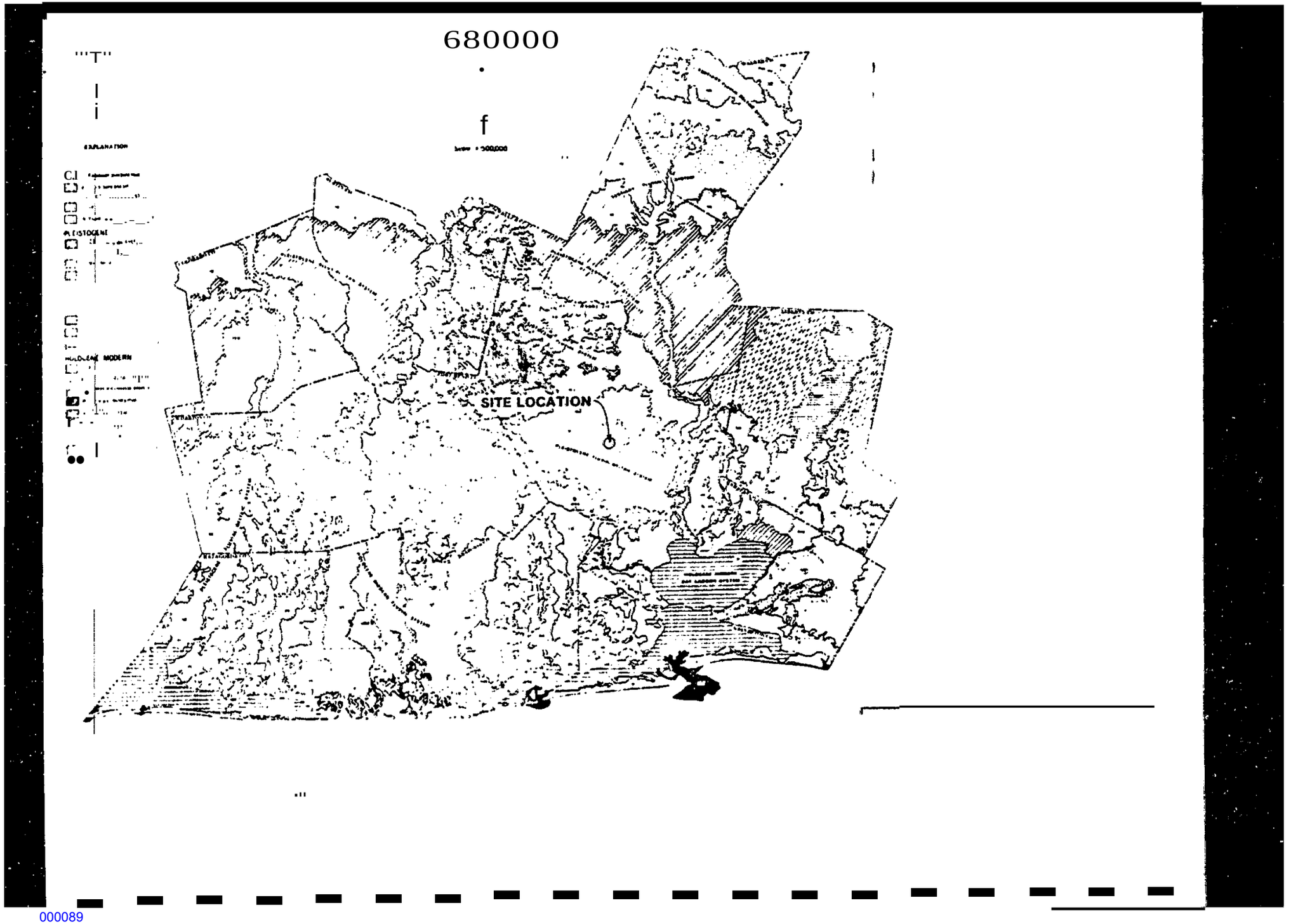
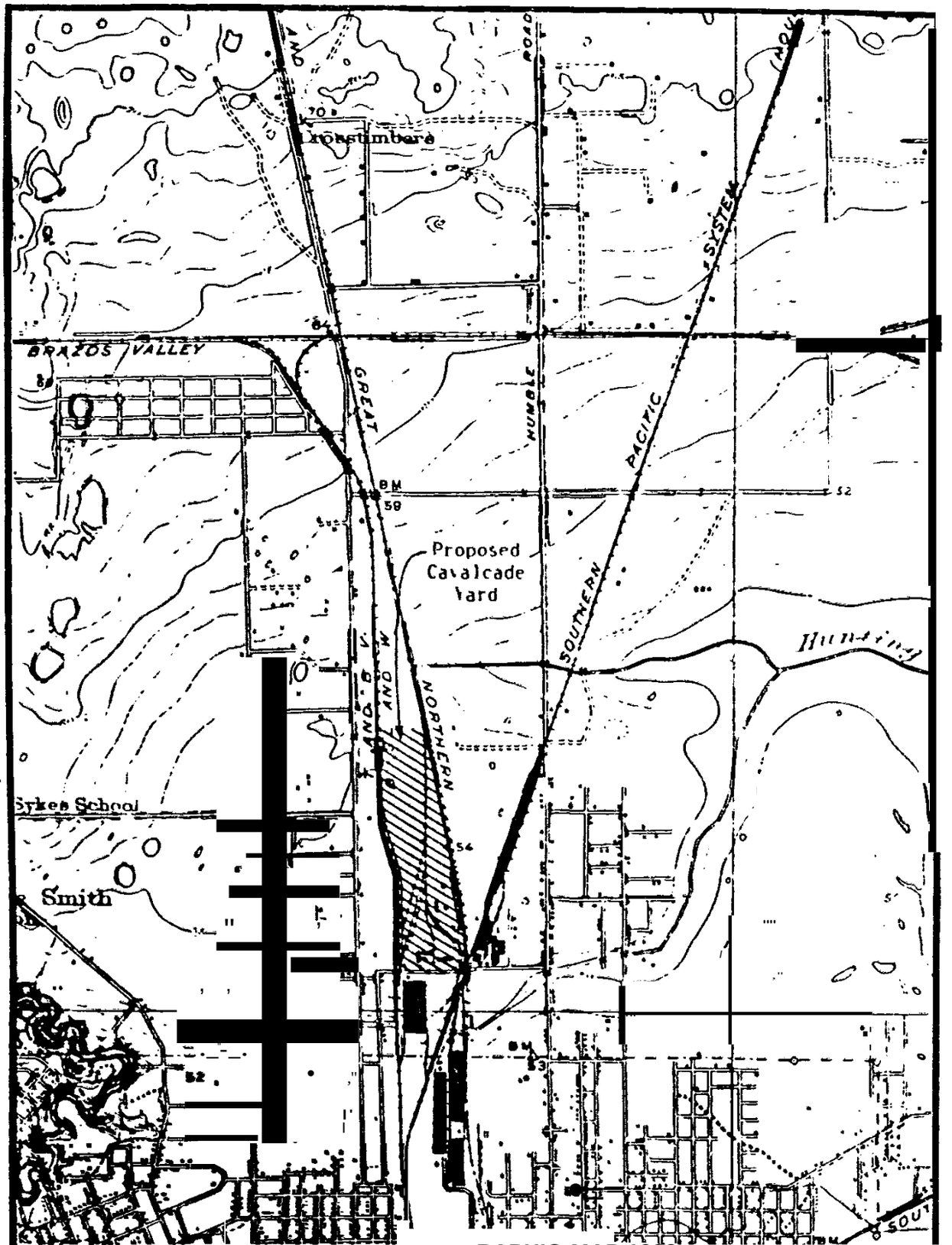
PLATE 5-4


680000
SITE LOCATION



RAPHIC MAP.1922

SITE TOPOG 2000 ft)

(1 in. = "

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PLATE 5-6

000090

6.0 SITE INVESTIGATION

The Cavalcade Yard site investigation was conducted in two phases of work. Phase 1 scope of work was designed to provide information on the extent and types of contamlnation at selected locations throughout the site. As discussed in Section 3.4, Phase 1 was conducted based on the original facility layout. The investigation did not include a 20-acre area at the south end of the current facility layout. Phase 2 SCOpe of work included exploration for contamination at the proposed areas of future structures. Phase 2 was conducted based on the current facility layout but was terminated before completion.

6.1 Introduction

This section is organized into two main discussions. first, a description of the slte investigation program is presented. This includes the objectives and details of the work performed. The Second discussion covers the sampling program. This portion includes the objectives, sampling identificatl0n, and the sampling procedures. Also presented is a brief interpre. tation of the analytical results.

6.2 Site Investigation Program

The Cavalcade Yard site investigation program covered a variety of tasks. The primary objective was to determine the site's suitability fOl the proposed land use. This required a general assessment of hazardous waste contaminatl0n at the site. The site investigation included suspected areas identified during the HIstorical Review (Section 4) and the proposed locations of future construction.

As previously mentioned, the site investigation program was not completed because the project was terminated during the course of the study. The following listing includes the tasks completed during the investigation. Section 9 contains recommendations on additional tasks required to complete the study.

	NUMBER COMPLETED
Sediment Sampling	5
Surface Water Sampling	2
Surficial Soil Sampling	4
Soil Borings	13
Subsurface Soil Sampling	16
Shallow Observation Wells	12
Deep Observation Well	1
Production Well Sampling	3

Soil Borings. soil borings were used to obtain the subsurface soil samples throughout the site and also to identify the extent of the shallow sand layer.

Sixteen sample borings were collected at various locations to obtain soil sacnples for analytical testing. Disclosure of visually contaminated soils or noticeable odors was documented in the field. Plate 6-1 shows the approximate locations of the subsurface (deep) soil samples. These locations were based on suspected wood treating operations and disposal areas and were consecutively numbered, using a "CAV-SL" prefix. Section 6.3 explains in detail the sample identification system. Seven soil borings at the southern portion of the site were not completed because sf property access problems. Therefore, the saropl ing sequence shown on Plate 6-1 does not include the follohing locations: CAV-SL-08, CAV-SL-09, CAV.SL-ll, CAV-SL-12, CAV-SL-13, CAV-SL-15, and CAV-SL-17.

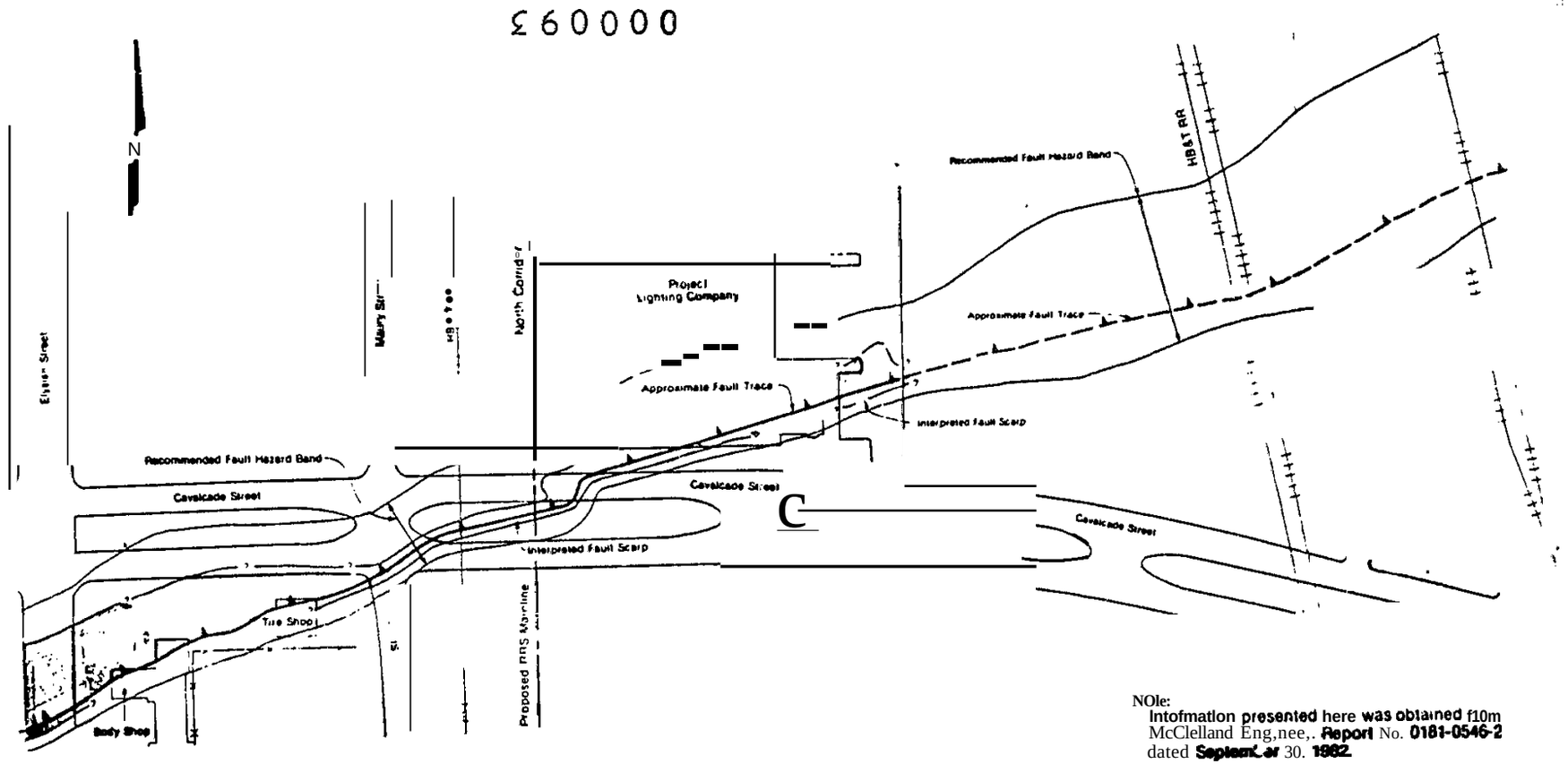
The three sample borings conducted during Phase 1 (CAV-SL-03 to CAV-5l-05) were advanced with a marsh buggy-mounted rotary drilling rig. The borings were advanced to a depth of 40 ft using standard wet rctary drilling practices. No drilling muds or polymers were used other than pure bentonite. Cohesive soil samples generally obtained, continuously to a depth of 10 ft, and at 5-ft intervals thereafter. The samples were obtained by hydraulically pushing a 3-in diameter, thin-walled tube. Selected soil samples were carefully trimmed and packaged under the supervision of the field scientist. Detailed sampling procedures are discussed further in Section 6.3. All of the boreholes were subsequently sealed with a non-shrink, cement grout upon completion.

The thirteen sample borings for Phase 2 were advanced primarily at the proposed building locations. The borings were advanced to a depth of 10 to 15 ft, or about 5 ft below the anticipated foundation excavation depths. The Phase 2 borings were drilled with a medium-duty, truck-mounted rotary drilling rig using dry augering techniques. No drilling fluids or recirculation of drilling muds were employed. Soil samples were generally obtained at 5-ft intervals USing a 3-in diameter, thin-walled tube. All Phase 2 soil samples were properly identified and placed into storage. No analytical tests were assigned. All of the boreholes were subsequently sealed with a non-shrink, cement grout upon completion.

Precautions were taken to reduce the possibility of cross-contamination between boring locations. All drilling equipment was thoroughly steam-cleaned and washed with a methanol solvent between each sample location. In addition, equipment and utensils used to collect the soil samples was also cleaned with a methanol solvent between each samp1ing interval.

Boring logs were prepared for all of the subsurface sample borings and are presented on Plates 6-2 to 6-17. A key to the terms and symbols used on the boring logs is presented on Plate 6-46. Each boring log identifies the sample location coordinates and ground surface elevation as well as all of the samples selected for testing or storage. In addition, air monitoring was performed as part of the Health and Safety Program (see Appendix I). Air monitoring was conducted using a portable HNU photoionizer meter. The HNU readings taken on the soil samples are recorded in units of parts per million (ppm) on the boring logs.

As mentioned in Section 5.2, thirteen soil borings were advanced along Cavalcade Street to aid in determining the east-west boundary of the shallow sand layer. Information from the Historical Study and Reconnaissance



NOle:
Intofmation presented here was obtained f10m McClelland Eng,nee,. Report No. 0181-0546-2 dated September 30. 1982.

O 50 100 150 Feet

Study identHied the general north-south boundaries of the shallow sand 1ayer.

Plates 6-32a through 6-32e show the approximate boring locations along Cavalcade Street. The soil borings were drilled at approximately 300-ft intervals from Irvington Street to Hardy Road and at approximately 500-ft intervals to Hunting Bayou. No borings were drilled where previous borings were located as referenced on Plates 6-32a to 6-32e. The Cavalcade Street borings were numbered consecutively from west to east, using ·CAV· prefix for their designat ion.

All of the soil borings were drilled with a medium duty, trucK.mounted drill rig. The borings were advanced us1ng wet rotary drilling procedu-es with recirculation of the drilling fluid. All of the borings were drilled to a depth of 40 ft. No attempt was made to decontaminate the drilling equipment between boring locations.

The soils were sampled at 5-ft intervals. Most of the soil samples were obtained by hydraulically pushing a 3-in diameter, thin-walled tube. Some of the cohesionless soil samples were obtained by driving a 2-in diameter, splIt-barrel sampler. Each sample was removed from the sampler and visually classified in the field. Representative portions of the samples were sealed and packaged for storage. The boreholes were subsequently backfIlled after completing the water level readings.

DetaIled Descriptions of the soils encountered are presented on the boring logs, Plates 6-33 to 6-45. Water level readings were generally ITade more thar two weeks after the borings were completed. The measured water levels and theIr corresponding date of observation are also presented on the borIng logs. A key to the terms and symbols used on the *boring* logs is presented *on* Plate 6-46.

Shallow Observation Wells. Twelve shallow observation wells were installed at selected locations throughout the site. The primary purpose of the observatIon wells was to establish groundwater flow characteristics at the site. Once the hydrogeologic conditions were identified, a groundwater monitoring program would have been established. However, the project was terminated before a groundwater monitoring program was initiated.

Plate 6-18 shows the approximate observation well locations. These loca. tions were chosen on the basis that the general direction cf groundwater flow was to the southeast. No future groundwater monitoring for the tract of land north of Cavalcade Street was anticipated. The observation well locations were numberea sequentially using an "CAV-OW" prefix. (lne well was not installed (CAV-OW-12) due to property access problems. Observation well CAV-OW-06 is a deep well (200 ft) and is discussed separately in the next section.

The observation wells were installed using medium duty, rotary drilling equipment. The first five wells were completed during Phase **1.** The boreholes were drilled using standard wet rotary procedures including recirculation of the drilling fluids. Howevp.r. this procedure was changed during Phase 2. Wet rotary techniques were still used to drill through the sand layer. But, instead of recirculating the drilling fluids, all drill-

ing mud was pumped unly *once* through the borehole and then wasted. No polymeric drilling muds were used during the installations. All drilling equipment and sampling tools were decontaminated between well locations.

Soil samples were generally obtained only when visual waste contamination was encountered. as directed by the field scientist. Groundwater samples were taken during Phase 1 work (CAV-OW-01 to CAV-OW-05) only. No groundwater samples could be Obtained for the remaining observation wells because of property access prOblems.

Plates 6-19 to 6-31 present logs of the soils encountered during the well lnstallations. A key to the terms and symbols used on the boring logs is presented on Plate 6-46. Each log identifies the sample location coordinates ana ground surface elevation. Sample numbers and HNU readings are also presented on the boring logs. The monitoring *zone* represents *the* depth locations actually subject to monitoring.

Plate 6-47 illustrates the typical well tonstruction details. All wells were constructed with a 2-in dIameter PVC riser with a 4-in diameter PVC protectlve casing. The protective casing was fitted with a locking device for security purpOSes. All joints were threaded to preclude the use of scI vents or glues. A bentonite seal was placed above the sand filter to isolate the monitoring *zone.* The well was then backfilled with a non. shrink, *cement* grout to prevent contact from surface water infiltration.

A summary of the as-built dimensions referenced on Plate 6-47 is presented on Plate 6-48. Alter wells were installed. they were developed to clear the monitoring zone of drilllng fluids and foreign matter introduced durIng the installation process. Well development was conducted by using a portable centrifugal pump. The wells were pumped until the water appeared consistently clear. A conductivity meter was also used to determine when the discharge water had reached steady-state conditions. After development the wells were allowed to stabilize to normal background conditIons belore sampling and water level readings were conducted•

Water level readings were taken over a period of five months. The readings were obtaIned using a weighted measuring tape. Plate 6-49 presents a summary of the groundwater elevations. All of the wells could not be read on the same dates due to property access prOblems. Observation well CAV-OW-09 has SUbsequently been disturbed.

Oeep Observation Well. A deep observation well was installed at the Cavalcade Yard site to obtain information on potential vertical migration of surficial contaminants into known groundwater drinking supplies. The *deep* well location (CAV-OW-06) is shown on Plate 6-18. The well extended to a 200-ft deep sand aquifer known to be presently used for domestic water supplies. Results from the survey of prouction wells in the site vicinity (see Section 5-6) indicate that the 200-ft deep aquifer is the shallowest known usable aquifer near the site.

Detailed well construction and sampling details were sent to the Texas Department of Water Resources (TOWR) for review and approval. Plates 6-50a to 6-50c are a copy of the letter sent to TOWR. Verbal approval of the letter was received on June 7, 1983.

The deep well was installed by Underground Resource Management (URM) of Austin, Texas. Detailed boring logs of the soils encountered during installation *are* presented on Plates *6-24a* and 6-24b. All construction, installation, and sampling procedures were performed under the direct supervision of a field SCIentist.

The data collected during and subsequent to the construction of the deep well includes;

- o Subsurface geologic and soil conditions. D.ta was'collected regarding the depth, thickness and condition of the underlying soil strata.

- o Subsurface contaminant conditions. field and laboratory analysis of subsurface soils was performed to provide information on the depth and extent of contamination.

- o Subsurface water levels and water Quality conditions. Water level measurements and groundwater samples were collected and analyzed to provide additional information regarding subsurface hydrogeolo9'c and water qualIty conditions.

Special precautions in both the well design and installation procedures were taken to provide representative and reliable analytical data. A summary of the installation procedures is presented as follows.

- o The well was constructed using mud rotary drilling techniques. The upper potentially contaminated soils were ·sealed off" once clean formation soils were encountered. The upper soils were ·sealed off· by employing an outer 6-in. diameter casing cemented in place. lhe remainder of the borehOle and well construction was advanced through the 6-in casing.

- o Soil samples were collected at regular intervals for the entire depth of the borehole. One sample at the bottom of the 6-in. casing and one sample below the aquifer sample were collected and analyzed for complete priority pvllutants. The remaining soil samples were field checked for visual contamination and placed into storage.

- 0 Strict equipment cleaning and decontamination procedures were employed during the well installation and sampling.

Detailed well drilling specifications were developed to provide better quality contol during installation. Acopy of the amended dilling specifications is included in Appendix I. Acopy of the URM installation logs are also included in Appendix I for reference. A summary of the installation procedures is presented as follows.

- 0 All equipment utilized during construction of the well was steam-cleaned prior to use. Oil. grease. and foreign material were removed for drill rods. drill bits. tanks. well casing. screens, sampling devices, and other contact equipment. Hoses. pumps, etc., were thoroughly flushed out with clean water.

- o Drilling fluid and drill cuttings were flushed from the drill hole on a regular basis and replaced with fresh fluid. Each time the fluid was changed all contact equipment was cleaned and flushed.

- o After the first 20 ft of the boring was drilled, the drilling fluid was replaced in the borehole and the soil cuttings cleaned out of the mud tank.

- o lhe borehole was then drilled to 130 ft deep and sampled at a 10 ft intervals. One fluid change and equipment cleanup was performed in the 20·120 ft interval. The borehole was then reamed to an 8-in diameter and the dilling fluid was changed at 120 ft.

- o lhe 6-in casing was cleaned, set and grouted (employing a non-Shrink cement bentonite grout tremied in place) from 120 ft to the ground surface. The grout was allowed to cure for at least 12 hours.

- o After groutIng, the 6-in casing was flushed and equipment Steam-cleaned prior to proceeding with the remaining drilling.

- a Drilling and sampling (at 10 ft intervals) continued from 120 ft to the bottom of the borehole. lhe last sample collected was from 25 ft to 30 ft below the sand aquifer.

- a Upon completion of the borehole, the bottom 25 ft to 30 ft was backfilled with clean sana. A 4-in diameter stainless steel well screen and 4-in casing were steam.cleaned, assembled, and lowered into place. lhe screened area of the well was sandpacked with clean sand to approxImately the top of the Sand aquifer. The remainder of the hole was filled with a non-shrink, cement-bentonIte grout by the tremie method. The grout was allowed to cure for at least 12 hours.

- o lhe well was then developed by air surging to clear silt and drilling fluid from the screened area. Four hundred to six hundred gallons were air pumped from the well and an initial grab sample was collected and analyzed.

- o A submersible pump was installed in the well and pumped for four days. About 12,000 gallons were removed prior to collecting the sample of record.

lwo waste by-prOducts were generated from the deep well installation. The drilling muds and soil cuttings were transported to a permitted TDWR Class 1 hazardous waste facility for disposal. The groundwater pumped from the well was disposed in a nearby sanitary sewer subject to the conditions of a City of Houston Industrial Waste Permit.

Production Wells. As described in Section 5.6, a survey was made of area production water wells currently in operation. A review of the published well records indicated three separate aquifers used in the site vicinity. Plate 5-8 presented a water well location map.

As part of the Site Investigation Program. three off-site production wells were sampled to assess the potential migration of contaminants from the s1te. The wells sampled represented each of the three aquifers identified in Section 5.6. The sampled wells are identified on Plate 5-8. The detailed sampling procedures and analytical results are presented In Section 6.9. The production well samples were identifed with a "CAY-PW" prefix. lable 6-} presents additional details and references pertaining to the sampled wells.

TABLE 6-1

PROOUCIIOh WELL DATA

Sample No.	Map Reference	Current Owner	Screen Depth, ft
CAY-PW-01	438	Olds Press and Forge	282 to 302
CAY-PW-02	2348	Lone Star Industries	508 to 548
CAY-PW-03	406	City of Houston	1143 and 1970

6.3 Sediment SamplIng (SOJ,

Objectives. Representative bottom sediments samples were collected along the course of the drainage dItch at the SOutheast corner of the site. These samples were collected to establish a bottom sediment quality baseline prIor to an) remedial actIon or construction activity. ho samples were collected olfsite along the railroad drainage dItch on the southeast corner 01 the sIte to determine if any offsite migration of contamination was occurring.

Sampling Procedures. Six (6) bottom sediment samples were collected from the drainage area on the southern end of the site. A grab sampling technIque as referenced in Procedure ho, 3816012 of the CDM Generic Sampling and Analytical Plan *tor* Uncontrolled Hazardous Waste Sites was used. For collection, the single tube core shallow water sldement (WILDeO 2400-A15) was used at all sampling locations. All sampling locations are identified on Figure 6-1. These sampling locations were co-located to surface water sample collection locations. All quality assurance, personal protectIon, special hazard precautions and chain-of-custody/documentation proceOures identified in the Site Specific Health and Safety/Sampling and Analytical Plan for the Cavalcade Yard Site were adhered to.

Sample Identification. For each individual sample collected, the sample numberIng procedure Identified in Appendix) was followed. A summary of all samples and locations are presented on Table 6.3. Sampling log sheets are also presented for each sample location In Appendix II.

Summary of Analytical Results

During the sediment sampling program, the following toxic compounds were encountered at concentrations above detection limits as specified by the analytical techniques utilized.

Volatile Organics (all values PPB, ug/kg wet weight)

Contaminant	50-01	50-02	50-03	SO-04	SD-05
Methylene Chloride	100	48	83	110	39

Refractory Organics (all values PPB, ug/kg, wet weight)

Contaminant	50-01	SD-02	50-03	SO·04	SD-05
Anthracene	240.	4700.	1600.	2100.	ND
Benzo(a)anthracene	550.	440.	620.	leOOO.	ND
6enzc(a)pyrene	500.	250.	600.	5400.	ND
3,4-Benzofluoranthene	IIOC.	890.	1300.	4800.	ND
BerZO(g,h,i)perylene	430.	ND	I,D	ND	ND
Bis(2-ethylhexyl)phthalate	210.	ND	ND	ND	ND
Chrysene	550.	530.	680.	14000.	ND
Fl oranthene	1100.	750.	1200.	25000.	320.
Indeno(I,2,3,-c,d)pyrene	320.	1,0	600.	ND	ND
Phenanthrene	650.	ND	860.	1400C.	ND
Pyrene	850.	690.	11 00.	22000.	260.
Fluorene	ND	360.	ND	520.	ND
Aceraphthene	ND	ND	ND	580.	ND

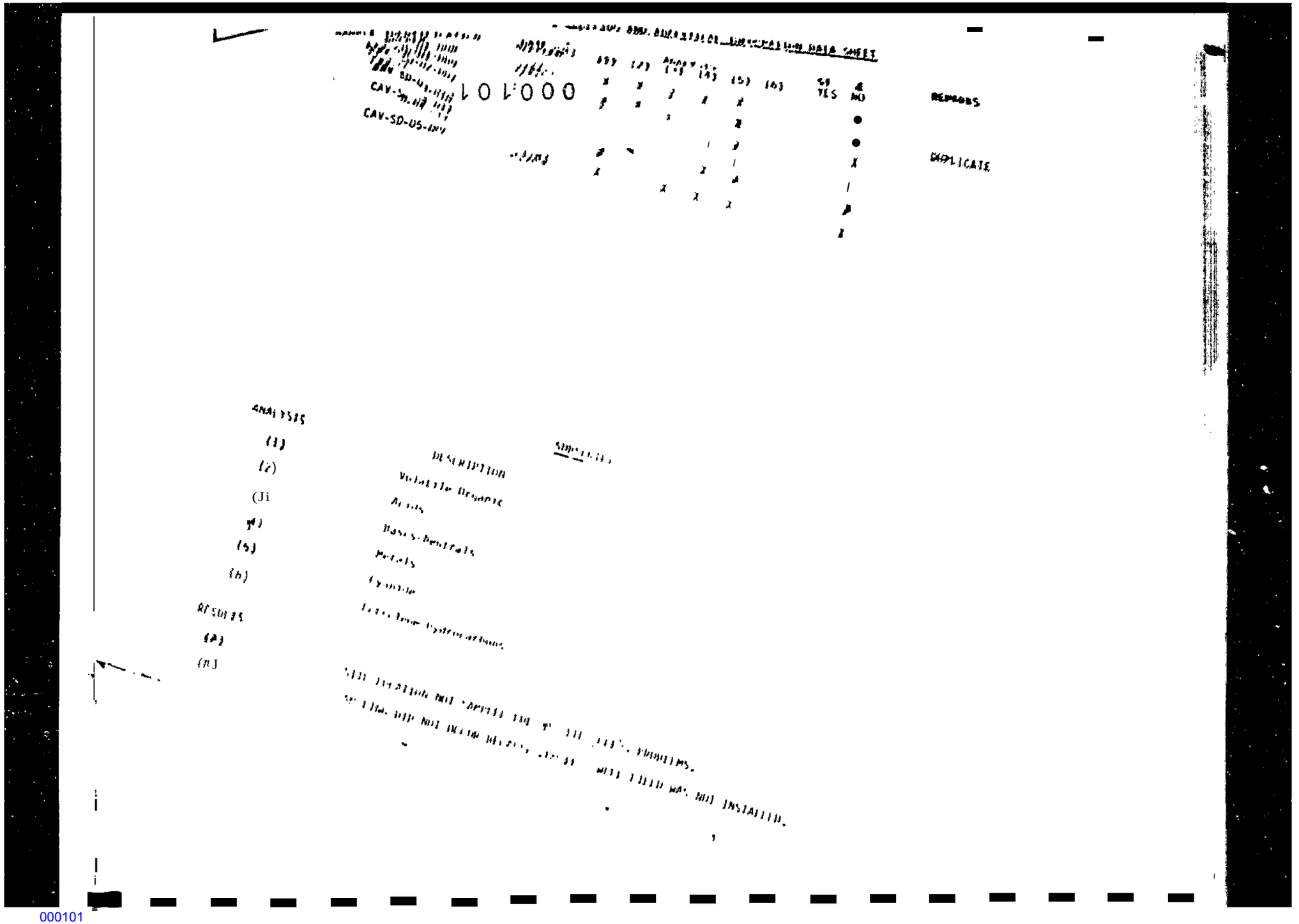
Toxic Metals andlnorganics (all values PPM, mg/Kg, wet weight)

ConUminant	50-01	SD-02	SD-03	SD-04	SD-05
Arsenic (As)	2.0	2.4	1.5	2.2	1.5
Beryllium (Be)	0.2	0.6	0.3	0.5	0.2
Cadmium (Cd)	0.8	0.6	1.0	1.4	ND
Chromium (Cr)	10:0	13.0	12.0	9.7	6.8
Copper *(Cu)*	13.0	60.0	21.0	82.0	21.0
Lead (Pb)	61.0	88.0	69.0	185.0	20.0
Mercury (Hg)	0.025	0.043	0.032	0.006	0.006
Nickel (Ni)	4.5	4.9	5.4	2.7	2.7
Silver (Ag)	0.40	0.06	ND	ND	ND
Thallium (Th)	NO	0.06	0.97	ND	ND
Zinc (Zn)	160.0	150.0	150.0	30.0	30.0

Discussion of Analytical Results. Volatile organic contamination of sediments both on and off site are of minimum environmental significance. The one volatile organic compound encountered, methylene chloride is a notorious laboratory contaminant. As a result, the low level (less than 1 PPM) methylene chloride sediment contamination indicated should be evaluated accordingly.

The prevalence of low level refractory organic compound. particularly the PC'j'nuclear aromatic hydrocarbon constituents is consistent with the disposal practices of the low technology creosoting operations previously identified as operating at this site. The Creosote waste products disposed of at this site over two decades ago have been subjected to the natural "weathering" forces of the environment (evaporation. biological decomposition, etc.) and as a result, only the more refractory nonvolatile. and/or persistent compounds remain in the sediment. It should be noted that the highest concentration of these compounds are encountered off-site (SD-04) in the railroad drainage ditch to the east of the site.

The toxic metal contaminotion associated with on-site sediments 50-01. SU-02, 50-03. although posing no significant environmental impact may prove problematical with respect to ultimate disposal. The ability of this material to meet the requirements of the EP toxicity test (SW-846 Methods 3510 and 8080) with lead assays in excess of 50 PPM (wet weight basis) is Questionable.



000101

6.4 Surface Water Sampling

Objectives. Representative surface water samples were collected; (1) along the south site drainage ditch, and (2) along the course of the railroad bed drainage ditch. These samples were collected to establish surface water quality in the vicinity of the Cavalcade Yard Site and determine the relationship between surface waters and the various waste disposal areas situated in close proximity to the tributaries course.

Sampling Procedures. Two (2) surface water samples were collected from the drainage areas. A grab type sampling method *(reference* No. 816002) as identified in the COM Generic Sampling and Analytical Plan for Uncontrolled Hazardous Waste Sites was used. All sampling locations are identified on Figure *b·1.* These sampling locations were co-located to sediment sample locations. All quality assurance, personal protection, special hazard precautions and chain-of-custody/documentation procedures identified in the Site speCIfic Health and Safety/Sampling and Analytical Plan for the Cavalcade Yard Site were adhered to.

Sample Identification. For each individual sample collected, the sample numbering *procedure* identIfied in Appendix I was followed. *A summary* of all samples and locations are presnted on Table 6.4. Sampling log sheets are also presented *for* each sample location in Appendix I.

Summary of Analytical Results. During the surfacewater (5W) sampling. progran" the following toxic compoundS *were* encountered at concentratIons above detection limits as specified by analytical techniques utilized.

Volatile Organics

No volatile organics detected.

Refractory Organics (all values reported as PPB, ug/l)

Contaminant	SW-01	SW-02
Benzo(a)anthracene	ND	10.
Benzo(a)pyrene	ND	10.
3,4-benzofluoranthene	ND	21.
BenZO(k)fluoranthene	ND	21.
Chrysene	ND	12.
Di-n-butyl phthalate	ND	18.
Fl uoranthene	ND	17.
pyrene	ND	14.

loxic Metals and Inorganics (all values removed as PPM, mg/l)

Contaminant	SW-01	SW-02
Cadmium (Cd)	0.05	ND
Zinc (2n)	0.32	0.18

Discussion of Analytical Results. There is no indication of surface water contamination on site as indicated by the absence of volatile organics, refractory organics and toxic metals in excess of primary (0.05 PPM Cd) and secondary (5.0 PPM Zn) drinking water standards at location SW-01. Low-level contamination «100 PPB) of a variety of polynuclear aromatic hydrocarbon was observed in the railroad drainage ditch to the east of the site.

000103

TABLE 3.4

SURFACE WATER (SW) SAMPLING AND ANALYTICAL INFORMATION DATA SHEET

SAMPLE IDENTIFICATION NUMBER	DATE SAMPLED	ANALYSIS (1)	(2)	(3)	(4)	(5)	(6)	STORAGE YES	STORAGE NO	REMARKS
CAV-SW-01-013	2/22/83	X	X						X	
CAV-SW-02-012	2/22/83	X	X						X	

SUBSCRIPTS

ANALYSIS	DESCRIPTION
(1)	Volatile Organic
(2)	Acids
(3)	Bases/Neutrals
(4)	
(5)	Cyanide
(6)	Petroleum Hydrocarbons

RESULTS

(A) SEEP LOCATION NOT SAMPLED DUE TO SITE ACCESS PROBLEMS.

(B) SCREENING DEPTH NOT DEEP BECAUSE CONCRETE WELL FIELD WAS NOT INSTALLED.

000104

000104

6.5 Surface Soil Sampling (SLl

Objectives. Six (6) surficial soil samples were collected to characterize the physical nature of the soils present on the site and determine the degree of contamination of the soils located adjacent to areas used or alleged to be used for waste disposal. No off-site samples were collected to quantify the degree *of* contamination at the site to the immediate surrounding environment. These samples were collected at locations suspected of containing large deposits of creosote and wood-preserving prOducts.

Sampling Procedures. A total of six (6) surficial soil samples were collected a various locations at the site. A review of initial surveys and aerial photographs has revealed areas of potential contamination that were investigated by probing shallow depths. Hand operated soil augers were used to obtain these surfIcial soil samples. 1he procedures for general sCll sampling (reference No. 3816099) and surface and shallow depth soil sa'pling (reference No. 3816029) from the CDM Generic Health and Safety Plan were followed during saMpling activities. All quality asurance. personal protection and chain-of-custody/documentation procedures 1ncluded in the Slte Specific Health and Safety/Sampling and Analytical Plan for the Cavalcade Yard SHe (Appendix II) were followed during this sampling activity. lhese samples were used in conjunction with the deep soil borings to provide a complete descrIptIon of the chemical characteristics of the SOIl and contamInation at this site.

Sample Identification. Each surficial soil sample collected was recorded by the method identified 1n the site specific plan contained in Appendix I. A summary of all samples and locations are presented on Table 6.5 Sampling location log sheets are also presented for Each sample location in Appendix II.

Summary of Analytical Results. Dunng the Surface Soil (St) Sampling Progran;. the following priorIty pollutant compounds were encountered on site at concentrations above detectIon lImits as specified by analytical techniques specified.

Volatile Organics (all values PPB, ug/kg wet weight)

Contaminant	SL-01	SL-02	St-03	St-04
Methylene Chloride	S9	39	59	ND
EthyIbenzene	ND	ND	ND	160
loluene	ND	ND	ND	23

Refractory Organics (all values PPB, ug/kg, wet weight)

Contaminant	SL-04	SL-02	SL-03	SL-OI
Acenaphthene	100,000	ND	7BO.	ND
Acenaphthjlene	3,000	ND	2400.	ND
Anthracene	240,000	ND	12000.	NO
Benzo(a)anthracene	17,OCO	ND	32000.	200.
Benzo(a)pyrene	4,600	ND	21000.	ND
3,4-berzofluorathene	10,000	ND	46000.	260.
Berzo(g,h,l)perylene	ND	ND	7200.	ND
Benzo(k)fluoranthene	10,000	ND	46000.	260.
Chrysene	11,000	ND	42000.	200.
Fluoranthene	260,00(	ND	120000.	NO
Fluorene	80,000	ND	980.	ND
Indeno(I,2,3-c,d)pyrene	ND	ND	7200.	ND
Naphthalene	340,000	ND	1000.	ND
Phenanthrene	240,000	ND	2000.	ND
Pyrene	170.000	ND	110000.	10.
Di.n·octyl phthalate	NO	11	ND	ND

Toxic Metals and Inorganics (all values PPM, lng/kg, wet weight)

Contaminant	SL·04	SL-02	SL-03	SL-OI
Arsenic (As)	0.35	2.5	82.0	1.8
Beryllium (Be)	0.29	ND	0.20	0.26
Cadmium (Cd)	0.88	ND	0.10	NO
Chromium (Cr)	12.0	7.6	79.0	14.0
Copper (Cu)	4.4	32.0	21.0	NO
Lead (Pb)	B.4	31.0	54.0	3.4
Mercury (kg)	0.005	O.OOg	0.040	0.020
Nickel (Ni)	8.6	33.0	2.7	2.3
Sliver (Ag)	0.7	NO	0.20	ND
Thallium (11)	ND	ND	0.10	NO
Zinc (2n)	14.0	40.0	290.0	150.0

Discussion of Analytical Results. The previously identified disposal areas, particularly Sl-03 are highly contaminated with both polynuclear aromatic hydrocarbons and toxic metals at the surface. The ability of this material to meet the requirements of the EP toxicity test (SW-846 Method 3510 and B080) even after onsite treatment (biological. incineration) is questionable because of the high toxic metal assay. The high concentration of Pb and As at these locations would probably preclude any disposal option except in a secure landfill (Class I).

Other on site areas surveyed during the surface soils sampling program Sl-Ol and Sl-02 showed minimal organic contamination. There is some

6.6 Subsurface Soil Sampling

Objectives. Subsurface soil samples were collected to characterize the depth of contamination and the structure Of the underlying soils. No off-site locations were sampled, however, it is assumed that the underlying sotl structure on-site is in conjunction with that off-site. The majority of these sampling locations are located at either areas suspected of containing contamination or location of future Juilding foundations and areas of extensive excavatIon.

Sampling Procedures. A total of seventy-one (71) samples at sixteen (16) locations were collected using both phases of the field investigation at Cavalcade Yard. Initially a total of thirty-two (32) samples were collected at three (3) locations during the first phase. The second phase consisted of another forty-eight (48) samples being collected and an additional thirteen (13) locations. Another ten (10) sampling locations were identified although the procedures could not be carried out because of slte access problems. The sampling internal consisted of continuous samples from ground surface to 10' below ground surface than at 5' intervals to 40 feet. For shallow depth holes [10') samples were collected at 2', 6' and 8' depths below the ground surface. Samples were collected using rotary drilling equipment and attaching a 3" thin wall 2' long Shelby tube to the bottom of the drill string and pressing the tube into the soil at the bottom of the bore hole. These samples were removed from the drIll strtng, the soil extruded, trinuned of 1/2" • 1" of the outer skin and ends, examined, described, sectioned. and bottled as appropriate. All sampling equIpment was cleaned before reuse. All quality assurance, personal proteCllon, and chain-of-custudy/docun'entation procedures inclUdd in the Site Specifl c health and Safety/Sampling and anlaytical Plan for the Cavalde Yaro Site (Appendix II) were follOwed during this sampling activity. BorIng logs were collected during all sampling actlvities. The analysis of these samples in conJunction with the surface samples were used to provide a complete descriptlon of the chemIcal characteristics of the soil and contamination at thlS site.

Sample Identification. Each subsurface soil sample collected was recorded by the method Identified in the site specific plan contained in Appendix I. A summary of all samples and locations are presented on Table 6.6. Sampling location log sheets are also presented for each sample location in Appendix II.

Summary of Analytical Results. During the subsurface boring program the following compounds were encountered on-site at concentrations above detection limits specified by the analytical technique utilized. Data for each sampling location is presented separately. The depth of boring advancement in feet from the surface is indicated by the number in parenthesis.

Sl-03 (All organic values PPB, ug/kg, all inorganic values PPM, mg/kg wet weight basis)

Volatile Organic Contaminants	01 (2)	02 (5)	03 (10)
Methylene chloride	59	40	33

Refractory Organic Contaminants

Acenaphthene	780.	ND	ND
Acenaphthylene	2400.	280.	ND
Anthracene	12000.	1000.	ND
Benzo(a)anthracene	32000.	5600.	ND
Benzo(a)pyrene	21000.	20rr.	ND
3,4-Benzofluoranthene	46000.	6800.	ND
BenZC.9,h,l)perylene	7200.	1600.	ND
Benzo(k)fluoranthene	46000.	6800.	ND
Chrysene	42000.	4500.	ND
Fluoranthene	120000.	24000.	ND
Fluorene	580.	ND	ND
Indeno(l,2,3-c,d)pyrene	7200.	1800.	ND
Naphthalene	1000.	ND	ND
Phena"threne	20000.	5600.	ND
Pyrene	110000.	20000.	ND

SL-03	01 (2)	02 (5)	03 (10)

loxic Metal Contaminants

Arsenic (Ar)	82.0	1.5	0.33
Beryllium (Be)	0.20	0.20	0.20
Cadmium (Cd)	0.10	ND	NO
Chromium (Cr)	79.0	14.0	3.4
Lopper (Cu)	21.0	1.9	1.3
lead (Pb)	54.0	7.2	7.2
Mercury (Hg)	0.040	0.620	0.009
Nickel (Ni)	2.7	3.0	2. I
Silver (Ag)	0.20	ND	0.88
lhallium (Tl)	0.10	ND	NO
Zinc (2n)	290.0	23.0	3.6

evidence of toxic metal contamination (Pb, Cu, Ni >30 PPM) in the southeast Quandrant of the site.

SL-04 (all organic wet weight basIs) values PPB. ug/kg. all toxic metal values PPM mg/kg.

Volatile Organic

Contan,i nant s	01 (2)	02 (5)	03 (10)	04 (15)
- Et nX1benzene	150	98	10	ND
Methylene ChlorIde	ND	52	73	ND

Refractory OrganIC ~~Contarrinants~~

Acenaphthene	100000.	360000.	B0000.	540.
Acenaphthylene	3000.	ND	3200.	ND
Anthracene	240000.	520000.	48000.	580.
Benzo(a)anthracene	17000.	27000.	28000.	320.
Benzo(a)pyrene	4600.	7600.	32000.	460.
3,4-benzofluoranthene	10(100.	16000.	7200.	340.
Benzo(g,h,i)Perylene	ND	ND	50eO.	ND
benzo(k)fluoranthene	10000.	16000.	7200.	340.
Chrysene	IIOOe.	20000.	36(100.	320.
Dibenzo(a,h)anthracene	ND	ND	50eO.	ND
fluoranthene	260(00.	440000.	120000.	2000.
fluorene	80000.	110000.	64000.	340.
Indeno(1,2,3-c,d)pyrene	ND	ND	ND	ND
Naphthalene	340000.	640000.	200000.	ND
Pheranthrene	240000.	1100000.	180000.	4400.
Pyrene	170000.	280000.	88000.	14(\0.
2,4'[lmethylpheIlO!	ND	ND	ND	ND
SL-C4				

Toxic MetaI Contaminants	01 (2)	02 (5)	03 (10)	04 (20)
ArsenIC	I.B	2.0	1.2	0.29
Beryllium	0.26	0.28	0.6	0.31
Cadmium	ND	ND	0.5	ND
Chromium	14.0	4. I	8. I	3.7
Copper	ND	0.56	7.7	1.2
Lead	3.4	0.37	9.1	6.4
Mercury	0.020	0.005	0.004	0.005
Nickel	2.3	3.70	15.0	4.50
Silver	ND	ND	1.2	ND
Zinc	15.0	23.0	24.0	5.8

Discussion of Analytical Results. Although the previously identified disposal areas are highly conta,inated with both organic and inorganic

compounds at the surface, the contamination is attenuated with depth. At sampling location SI-03 the bottom most sample (10 ft) is free of any significant organic or inorganic contamination.

The decrease in concentration from the surface to the bottom of the boring is a factor of 100 for many of the polynuclear-aromatic hydrocarbons and volatile organic compounds. The concentration of Zn (the most significant inorganic contaminant) is attenuated by a factor of almost 30 from the Surface to the bottom of the boring.

These findings indicate that once these contaminated materials are excavated and removed from the site the most significant source of groundwater contamination for this site will be gone.

SURFACE SOIL (SL) SAMPLING AND ANALYSIS INFORMATION DATA SHEET

SAMPLE IDENTIFICATION NUMBER	DATE COLLECTED	ANALYSIS (1)	(2)	(3)	(4)	(5)	(6)	STORAGE YES	STORAGE NO	REMARKS
CAV-SL-03-001	2/1/83	X	X	X					X	
CAV-SL-03-002	2/3/83	X	X						X	
CAV-SL-03-003	2/3/83	X	X	X					X	
CAV-SL-03-004	2/3/83	X	X						X	
CAV-SL-03-005	2/3/83	X	X						X	
CAV-SL-03-006	2/3/83	X	X						X	
CAV-SL-03-007	2/3/83	X							X	
CAV-SL-03-008	2/3/83	X	X							
CAV-SL-03-009	2/1/83	X	X						X	
CAV-SL-03-010	2/3/83	X							X	
CAV-SL-03-011	2/3/83	X							X	
CAV-SL-04-001	2/4/83		X						X	
CAV-SL-04-002	2/4/83	X	X							
CAV-SL-04-003	2/4/83	X							X	
CAV-SL-04-004	2/4/83		X						X	
CAV-SL-04-005	2/4/83	X							X	
CAV-SL-04-006	2/4/83	X	X						X	
CAV-SL-04-007	2/4/83	X	X						X	
CAV-SL-04-008	2/4/83	X	X							
CAV-SL-04-009	2/4/83	X								
CAV-SL-04-010	2/4/83								X	
CAV-SL-04-011	2/4/83	X							X	
CAV-SL-05-001	2/5/83									
CAV-SL-05-002	2/5/83									
CAV-SL-05-003	2/5/83									

000112

TABLE 6,6 CONTINUED

SEDIMENT/SOIL (SE) SAMPLING AND ANALYTICAL INFORMATION DATA SHEET

SAMPLE IDENTIFICATION NUMBER	DATE SAMPLED	(1)	(2)	ANALYSIS (3)	(4)	(5)	STORAGE YES	NO	REMARKS
CAV-SE-05-004								X	
CAV-SE-05-005	7/31/			,					
CAV-SE-05-006		,	X	,					
CAV-SE-05-006		X	X		,			X	
CAV-SE-05-007		,	,					X	
CAV-SE-05-008			,					X	
CAV-SE-05-009									
CAV-SE-05-010		X	X						
CAV-SE-08-001									
CAV-SE-08-002									NOT SAMPLED IA)
CAV-SE-08-003									NOT SAMPLED (A)
CAV-SE-09-001									NOT SAMPLED IA)
CAV-SE-09-002									NOT SAMPLED fA J
CAV-SE-09-003									NOT SAMPLED (A)
CAV-SE-10-001									NOT SAMPLED rA J
rAV'SE-10-002	8/4/03	NO ANALYSIS PERFORMED					X		
CAV-SE-10-003		NO ANALYSIS PERFORMED					X		
CAV-SE-It.ltnl		NO ANALYSIS PERFORMED					X		
CAV-SI-Il_tlII?									NOT SAMPLED IA I
CAV'SI_II.Ii.')									Nnl SAMPLED (A)
CAV'SI-I?_II'"									NO SAMPLED (A)
CAV-SE-12-002									N"T SAMPLED (A I
fAV'SI_I?'"J									NOT SAMPLED (A J
CAV-SE-13-001									NOT SAMPLED (A)
CAV-SE-13-002									NOT SAMPLED (A J
									NOT SAMPLED (A I

TABLE 6.G CONTINUED

SUBSURFACE SOIL (SL) SAMPLING AND ANALYTICAL INFORMATION DATA SHEET

SAMPLE IDENTIFICATION NUMBER	DATE SAMPLED	(1)	(2)	(3)	(4)	(5)	(6)	STORAGE YES	STORAGE NO	REMARKS
CAV-SL-13-003										
CAV-SL-14-001										NOT SAMPLED (A)
CAV-SL-14-002								X		
CAV-SL-14-003								X		
CAV-SL-15-001								X		
CAV-SL-15-002										NOT SAMPLED (A)
CAV-SL-15-003										NOT SAMPLED (A)
CAV-SL-16-001	5/7/83	NO ANALYSIS REQUESTED								NOT SAMPLED (A)
CAV-SL-16-002	5/7/83	NO ANALYSIS REQUESTED						X		
CAV-SL-16-003	5/7/83	NO ANALYSIS REQUESTED						X		
CAV-SL-17-001										
CAV-SL-17-002										NOT SAMPLED (A)
CAV-SL-17-003										NOT SAMPLED (A)
CAV-SL-18-001	5/7/83	NO ANALYSIS REQUESTED						X		NOT SAMPLED (A)
CAV-SL-18-002	5/7/83	NO ANALYSIS REQUESTED						X		
CAV-SL-18-003	5/7/83	NO ANALYSIS REQUESTED						X		
CAV-SL-20-001	5/7/83	NO ANALYSIS REQUESTED						X		
CAV-SL-20-002	5/7/83	NO ANALYSIS REQUESTED						X		
CAV-SL-20-003	5/7/83	NO ANALYSIS REQUESTED						X		
CAV-SL-21-001	5/12/83	NO ANALYSIS REQUESTED						X		
CAV-SL-21-002	5/12/83	NO ANALYSIS REQUESTED						X		
CAV-SL-21-003	5/12/83	NO ANALYSIS REQUESTED						X		
CAV-SL-22-001	5/12/83	NO ANALYSIS REQUESTED								
CAV-SL-22-002	5/12/83	NO ANALYSIS REQUESTED								
CAV-SL-22-003	5/12/83	NO ANALYSIS REQUESTED								

000114

TABLE 6.6 CONTINUED

SURFACE SOIL (SE) SAMPLING AND ANALYTICAL INFORMATION DATA SHEET

SAMPLE IDENTIFICATION NUMBER	DATE SAMPLED	ANALYSES (1) (2) (3) (4) (5)	STORAGE YES NO	REMARKS
CAV-SE-23-001		NO ANALYSIS PERFORMED	,	
CAV-SE-23-002		NO ANALYSIS PERFORMED		
CAV-SE-23-003	5/9/89	NO ANALYSIS PERFORMED		
CAV-SE-24-001		NO ANALYSIS PERFORMED	,	
CAV-SE-24-002		NO ANALYSIS PERFORMED	,	
CAV-SE-24-003		NO ANALYSIS PERFORMED	,	
CAV-SE-25-001		NO ANALYSIS PERFORMED	,	
CAV-SE-25-002		NO ANALYSIS PERFORMED	,	
CAV-SE-25-003		NO ANALYSIS PERFORMED	X	
CAV-SE-26-001		NO ANALYSIS PERFORMED	,	
CAV-SE-26-002		NO ANALYSIS PERFORMED	,	
CAV-SE-26-003		NO ANALYSIS PERFORMED	,	
CAV-SE-27-001	5/7/89	NO ANALYSIS PERFORMED	X	
CAV-SE-27-002	5/7/89	NO ANALYSIS PERFORMED	,	
CAV-SE-27-003		NO ANALYSIS PERFORMED	,	
CAV-SE-28-001		NO ANALYSIS PERFORMED	,	
CAV-SE-28-002				NOT SAMPLED (A)
CAV-SE-28-003				NOT SAMPLED (A)
CAV-SE-79-0UI				NOT SAMPLED (A)
CAV-SE-29-002				NUT SAMPLED (A)
CAV-SE-29-003				NOT SAMPLED (A)
CAV-SE-30-001				NOT SAMPLED (A)
CAV-SE-30-002				NOT SAMPLED (A)
CAV-SE-30-003				NOT SAMPLED (A)
				NOT SAMPLED (A)

000115

SUBSURFACE

ANALYSIS	DESCRIPTION
(1)	Volatile Organic
(2)	Acids
(3)	Bases/Neutrals
(4)	
(5)	Cyanide
(6)	Petroleum Hydrocarbons

RESULTS

(A) SEEP LOCATION NOT SAMPLED DUE TO [illegible] ACCESS PROBLEMS.

(B) SAMPLING DID NOT OCCUR BECAUSE [illegible] WELL FIELD WAS NOT INSTALLED.

000116

TABLE 6.5

SURFACE SOIL (PC) SAMPLING AND ANALYSIS DESIGNATION DATA SHEET

SAMPLE IDENTIFICATION NUMBER	DATE SAMPLED	ANALYSIS (1)	(2)	(3)	(4)	(5)	(6)	STORAGE FT. NO	REMARKS
CAV-SE-01-0001	illegible								
CAV-SE-02-0002	illegible								
CAV-SE-05-0006	illegible	X						X	
CAV-SE-06-0004			X					X	
CAV-SE-06-0005								X	DUPLICATE
CAV-SE-07-0004	illegible		X						

SUPPLEMENT

ANALYSIS	DESCRIPTION
(1)	Volatile Organic
///	
(3)	Base/Neutrals
(4)	Metals
(5)	Cyanide
(6)	Petroleum Hydrocarbons

RESULTS

(-) SITE LOCATION NOT SAMPLED DUE TO SITE ACCESS PROBLEMS.

000117

000117

6.7 Shallow Groundwater Sampling

Objectives. Groundwater samples were collected to determine the extent of contamInation in the upper groundwater aquIfer present beneath the site. No off-site locations were sampled to determine if any contribution to contamination from off-site locations were occurring. Sample locations were identified to; (I) determine the direction Of flow Of the groundwater and (2) the *degree* of groundwater contamination adjacent to known waste disposal areas.

Well Installation Procedures. A total of twelve (12) shallow groundwater wells were installed *at* specified locations throughout the site. An additIonal well was scheduled to be installed but site access problems prevented installation. The procedures for monitoring well installation started with the use of drilling a 5" Olameter hole by hydraulic rotary methoas.

Cuttings produced during drilling were monitored to determine strata interface and thIckness. Screens that were 2" diameter and 5' long were set below the water bearing sand Jaler between 6" and 1'. Most screens were set between 15 to 18 feet below the ground surface. The wells were then backfilled with clean sand to the top of the sand layer, sealed with bentonite and then the remainder of the bore hole annuals with cement/grout mixture. A protectIve pipe was used to cover the hole and the well was developed by pumpIng water from it for 15-20 minutes until clear. A more detailed descrIptIon of shallow groundwater monItoring well installatlor procedures employed Jt the Cavalcade Yard site are contaIned in the site specifIc sampling plan.

Well Sampling Procedures. Only five (5) shallow groundwater monitOring wells were sampled at the sIte. The samplIng procedures consIsted of opening the observatIon well, pJmping between five (5) and ten (10) well volumes of water from the well and sampling the water with a stainless steel and Teflon bottom filling baller. All sampling and well installation downhole equipment was cleaned between locations to protect against cross contamination.

Sample Identification. Each shallow groundwater sample collected at the Cavalcade Yard site was recorded by the method identified in the site specific sampling plan. A summary of all shallow groundwater wells installed and sampled are presented on Table 6.7. Sample location log sheets for each well installation location are also presented in Appendix II.

Summary of Analytical Results. During the upper aquifer groundwater sampling program the following compounds were encountered On site at concentrations above detection limits specific by the analytical techniques **utll** *iled.*

VOlatile Organics (all values reported as PPB, ug/I)

Contaminants	0101-01	OW-02
Benzene	ND	2)
[thj Ibenzene	ND	58
Toluene	ND	liD

Refractory Organics (al l values reporteo as PPB. ugfl)

Cont ami nant S	01..·0)	OW-02
2,4-Dimethylphenol	ND	6eO
Pentachlorophenol	ND	66
Phenol	ND	59
Acenaphthene	49	3eC
Acenaphthylene	17	30
benzo(a)pyrene	ND	29
bis(2-ethylhexyl) phthalate	ND	17
butyl benzyl phthalate	ND	)7
Di-n-butyl phthalate	ND	34
f Juoranthene	23	34
f luorene	73	300
Naphthalene	67(	170(1(
Phenanthrene	160	240
Pyrene	)7	27

To.le Metals and)norganics (all values reported as PPM, mg/I)

Contaminant	OW-01	OW-02
ArseniC (As)	ND	0.)3
Copper (Cu)	0.06	ND
Zinc (2n)	O.)2	0.20
Total Cyanide (Cn)	0.70	0.10

Discussion of Analytical (low) aquifer Results. The organic contamination *observed* in the upper (shallow) aquifer is consistent with the surfieal contamination aSSOCiated with past diSposal practices at this site with the exception of the volatile organics Compounds observed in 0101-02. These aromatic hydrocarbons in *the* ratio detected are consistent with recent petroleum hydrOCarbon (gasoline) contamination.

Ihe levels of toxic metals observed in the upper aquifer *are* at or near (PA primary and SeCOndary drinking water standaros and pOse no significant

threat to health or the environment. It is encouraging to note the high levels of toxic metal contamination encountered in the surface soil samples are not reflected in the associated groundwater sample indicating that these metallic compounds are not in a mobile form in the soil.

The cyanide concentrations observed in wells OW-OI and OW-02 are inconsistent with any known industrial source on this site. The presence of this Chmnound in the groundwater sampled indicates there may be an off-site source of cyanide compounds.

6.8 Deep Groundwater Sampling

Objectives. A deep groundwater monitoring well was installed and sampled at the Cavalcade Yaro Site to determine the extent of contamination in the lower aquifer. The well was installed to the depth of the water bearing sand layer at approximately 180'-220' below the ground surface. No otf-site locations were sampled to determine if any contribution of pptential contamination exists from any offsite locations. Also only one groundwater well was installed to this depth su that movement of this groundwater could not be determined.

Well Installation Procedures. The lower aquifer groundwater monitoring well was installed by use of a wet rotary drilling system. The detailed installation procedures are referenced in Section 6.2. An initial six inch (6") diameter boring hole was used for development. To prevent contamination from upper sources the well was sealed off and diameter reduced. A screen was set in the water bearing sand layer at the desired depth. Two soil samples were taken in the soil that was immediately above and below the Screen depth. These samples were analyzed for any creosote contamination. The well was then backfilled with clean gravel pack and backfllled with a bentonite grout/cement mixture. The well was then developed by pumpin! with air until clear.

Well Sampling Procedures. The lower aquifer groundwater monitoring well was sampled twice. An initlal sample was taken directly after well development and then a sample was collect five (5) days after continuous pumping. After installation. a continuouS pumping system was used to clear any drilling fluid WhlCh may have entered the sand layer during installation. A sample that was representative of the groundwater was desirEj for analysis. The pump was removed before san'pling and a stainless steel bottom filling teflon bailer was used to collect the groundwater sanple. All qual ity assurance, personal protection, special hazard. and chain-of-custody procedures as identifled in the site specific plan were followed. The analysis of this sample was then used to determine the degree of contamination of this aquifer and connection with the waste disposal practices on the Cavalcade Yard site.

Sample Identification. Both lower aqulfer groundwater monitoring well samples collected were recorded by the method identified in the site specific plan. A summary of all samples and locations of both groundwater and subsurface soil samples are presented on Table 6-6-C. A sample location log sheet for the well installation location is contained in Appendix II.

Summary of Analytical Results. After the installation and development of the deep (200 ft) groundwater monitoring well a representative groundwater sample was collected after stabilization. In addition, during the instllation of this well a subsurface soil sample was collected from the clay horizion just above and just below the water bearing sand•. These samples were also submitted for analysis.

The following toxic compounds were encountered at concentrations above detection ';mit as specified by the analytical technique utilized.

Volatile Organics (all values reported as PPB, ug/l)

Contaminant	OW-06 (06)	Sl·11 (Soil) (11)	Sl-19 (Soil) (19)
Toluene	49	NO	ND

Refractory Organics

No Compounds detected.

Toxic Metals and Inorganics (all values repo-ted as PPM m9/1 or mg/kg wet weight)

Contaminant	OW-06	SL-ll (Soi 1)	SL-19 (Soi 1)
Antimony (Sb)	0.1	ND	ND
Arsenic (As)	0.05	12.0	12.0
Beryllium (Be)	ND	0.30	0.31
Cadmium, (Cd)	ND	0.30	0.31
Chromium (Cr)	ND	17.0	2.4
Copper (Cu)	ND	06	4.0
Lead (Pb)	ND	5.7	7.5
Mercury (Hg)	ND	0.003	ND
Nickel (Ni)	ND	1.5	4.6
Selenium (Se)	0.260	ND	NO
Silver (Ag)	ND	ND	ND
Thallium (11)	ND	2.1	1.9
Zinc (2n)	ND	3.1	7.3

Discussl0n of Analytical Results. With the exception of trace concentrations of toluene (49 PPB) the deep aquifer (200 ft) is uncontaminated with any other organic compound. Arsenic *and* Selenium are present at concentrations near primary drinking water standards and present no slgnificant health or environmentla risk.

The presence of toluene in the absence of other petroleum products (benzene, ethylbenzene) is unusual. The absence of these aromatic hydrocarbons iI' the clay horizon immediately above the well screen would indicate that the source of this contaminant may be from off-site sourceS.

It would be recommended that this well be re-sampled for volatile organic compounds and arsenic to verify the presence of these low lev€l contaminants.

Both soil samples were uncontaminated with organic compounds. The presence of organic at *12.0* mg/kg in sample Sl-11 may be indicative of a rather high natural background of this toxic metal in the natural clays at this site.

TABLE 6.7

GROUNDWATER (OW) SAMPLING AND ANALYTICAL INFORMATION DATA SHEET

SAMPLE IDENTIFICATION NUMBER	DATE INSTALLED	DATE SAMPLED	ANALYSIS (1)	(2)	(3)	(4)	(5)	(6)	REMARKS
CAV-OW-01-0005	2/7/83	2/8/83	X	X	X	X	X		
CAV-OW-02-0004	2/5/83	2/8/83					X		
CAV-OW-03-0003	2/7/83	2/8/83				X	X		
CAV-OW-04-0001	2/6/83	2/8/83				X	X		
CAV-OW-05-0002	2/7/83	2/8/83				X	X		
CAV-OW-06-0003		2/8/83				X	X		DUPLICATE OW-03
CAV-OW-07	5/3/83		[illegible] PERFORMED						NOT SAMPLED (B)
CAV-OW-08	5/3/83		[illegible] PERFORMED						NOT SAMPLED (B)
CAV-OW-09	5/5/83		[illegible] PERFORMED						NOT SAMPLED (B)
CAV-OW-10	5/4/83		[illegible] PERFORMED						NOT SAMPLED (B)
CAV-OW-11	5/5/83		[illegible] PERFORMED						NOT SAMPLED (B)
CAV-OW-12									NOT INSTALLED (A)
CAV-OW-13	5/6/83		[illegible] PERFORMED						NOT SAMPLED (B)
CAV-OW-14	5/7/83		[illegible] PERFORMED						NOT SAMPLED (B)

SUPPLIES

ANALYSIS	DESCRIPTION
(1)	Volatile Organic
(2)	Acids
(3)	Bases/Neutrals
(4)	
(5)	Cyanide
(6)	Petroleum Hydrocarbons

RESULTS

(A) SITE LOCATION NOT SAMPLED DUE TO SITE ACCESS PROBLEMS.

(B) [illegible]

000124

TABLE 6.8

GROUNDWATER (GW) SAMPLING AND ANALYTICAL INFORMATION DATA SHEET

SAMPLE IDENTIFICATION NUMBER	DATE INSTALLED	DATE SAMPLED	ANALYSES (1)	(2)	(3)	(4)	(5)	(6)	REMARKS
CAY-GW-06-[illegible]	5/12/83	5/12/83				X	X	X	SPECTRIX ANALYSIS
CAY-GW-06-0012	5/12/83	5/26/83				X	X	X	MEAD ANALYSIS

SUBSCRIPTS

ANALYSIS	DESCRIPTION
(1)	Volatile Organic
(2)	
(3)	Base/Neutrals
(4)	Metals
(5)	Cyanide
(6)	Extractable Hydrocarbons

RESULTS

"[illegible] LOCATION NOT SAMPLED DUE TO [illegible] WATER", PROBLEMS.

SAMPLING WELL NOT OCCUR PLEASE [illegible] WELL NOT INSTALLED.

0-00-0125

6.9 Production Well Samples

Objectives. Production wells which are located within close proximity to the Cavalcade Yard site were sampled to determine if any contamination which may be associated with the site exits. The wells depth ranged between approximately 300 and 500 feet below the ground surface. The purpose of the sampling procedure was to determine if contamination existed at this depth and not to determIne the source of contamination.

Sampling Procedures. The production well sampling occurred at three (3) locations as shown on Plate 6-8. Each sampling location was with a *one (1)* mile vicinity of the site. The site locations were located to the south, east, and northwest of the site. Sampling procedures consisted of purging the water from the exit water column and collecting a sample that was dIrectly from the water bearing sand layer. All quality assurance, personal protection. and chain-Of-custody procedures identified in the Site Specific Health and Safety/Sampling and Analytical Plan were adhered to.

Sample Identitication. All prOduction well samples collected were recorded by the method Identifled in the site specific plan. A summary of all prOductIon well samples and locations of the collection point are summarized on Table 6.7-C. A sample location log sheet for each sample location is presented in Appendix II.

Summary of Analytical Results. During the course of the field 'nvesti-gation program a selected number of production wells (PW) in the vicinity 01 the Cavalcade Yard site were sampled and analyzed to determine if there was any offsite impairment 01 groundwater quality. The following toxic compounds were encountered at concentrations above detection limits as specified by the anal)tlcal teChnique utilized.

Volatile Organics

No volatile organic compounds detected.

Refractory Urganics

No refractory organic compounds detected.

loxi, Metals and Inorganics (all values reported as PPM, mg/l)

Contaminant	PW-01	PW-02	PW-03
Cadmium (td)	NO	0.04	ND
lead (Pb)	0.35	0.35	0.30
Zinc (2n)	0.58	0.52	0.28

Discussion of Analytical Results. Offsite production wells are uncontaminated with volatile or refractory organic compounds. Metal concentrations in excess of primary drinking water standards were encountered in PW-01 (Pb) and PW-02 (Pb and Cd) and PW-03 (Pb). The primary drinking water standards for these compounds are 0.05 PPM for lead and 0.01 PPM for cadmium, respectively.

TABLE 6.9

PRIVATE WELL (PW) SAMPLING AND ANALYTICAL INFORMATION DATA SHEET

SAMPLE IDENTIFICATION NUMBER	DATE SAMPLED	ANALYSIS (1)	(2)	(3)	(4)	(5)	(6)	STORAGE YES	STORAGE NO	REMARKS
CAV-PW-01-0001	2/23/88	X	X	X					X	
CAV-PW-01-0002	2/23/88								X	
CAV-PW-01-0003	2/23/88								X	
CAV-PW-01-0004	2/23/88	X								DUPLICATE

SUBSCRIPTS

ANALYSIS	DESCRIPTION
(1)	Volatile Organic
(2)	Acids
(3)	Bases/Neutrals
(4)	Metals
(5)	Cyanide
(6)	Total Petroleum Hydrocarbons

RESULTS

(A) WELL LOCATION NOT SAMPLED DUE TO FREE ACCESS PROBLEMS.

000128

6.10 Site Health and Safety

This is an overview of the health and safety procedures employed at the Cavalcade Yard site. A more detailed description is contained in Appendix I. With the degree of hazard encountered at the site precautions must be implemented before any onsite activity takes place. A specific onsite health and safety plan was developed for all field investigation activitIes conducted at the Cavalcade Yard. This plan primarily consisted of: (I) Personal ProtectIon Guidelines, (2) Emergency Contingency Plan and (3) Specific Investigation Procedures with respect to hazard precaution and decontamInation/respIratory/and direct contact methods.

After review of the toxic and hazardous chemicals present at the Calvade Yard site a determination that all field investigations and sampling activitIes could be conducted a Level 0 protection. Level 0 protection, as defined in the Health and Safety Plan, consists of but not limited to:

Acid resistant coverall
Steel toe ana shank boots
Protective gloves

It was also specified that onsite air monitoring using the HNU photo analyzer during all fIeld activities would be conducted. The site-specific health and safety plan speCIfIes that an ambient reading be determined before activity occurs. PeriOdic measurements of the air were specified to monitor for potent,al hazard. If the recorded value increased 5 ppm above the background value, a requirement to advance to level C personal protectIon. Level C personal protection consists of but not limited to:

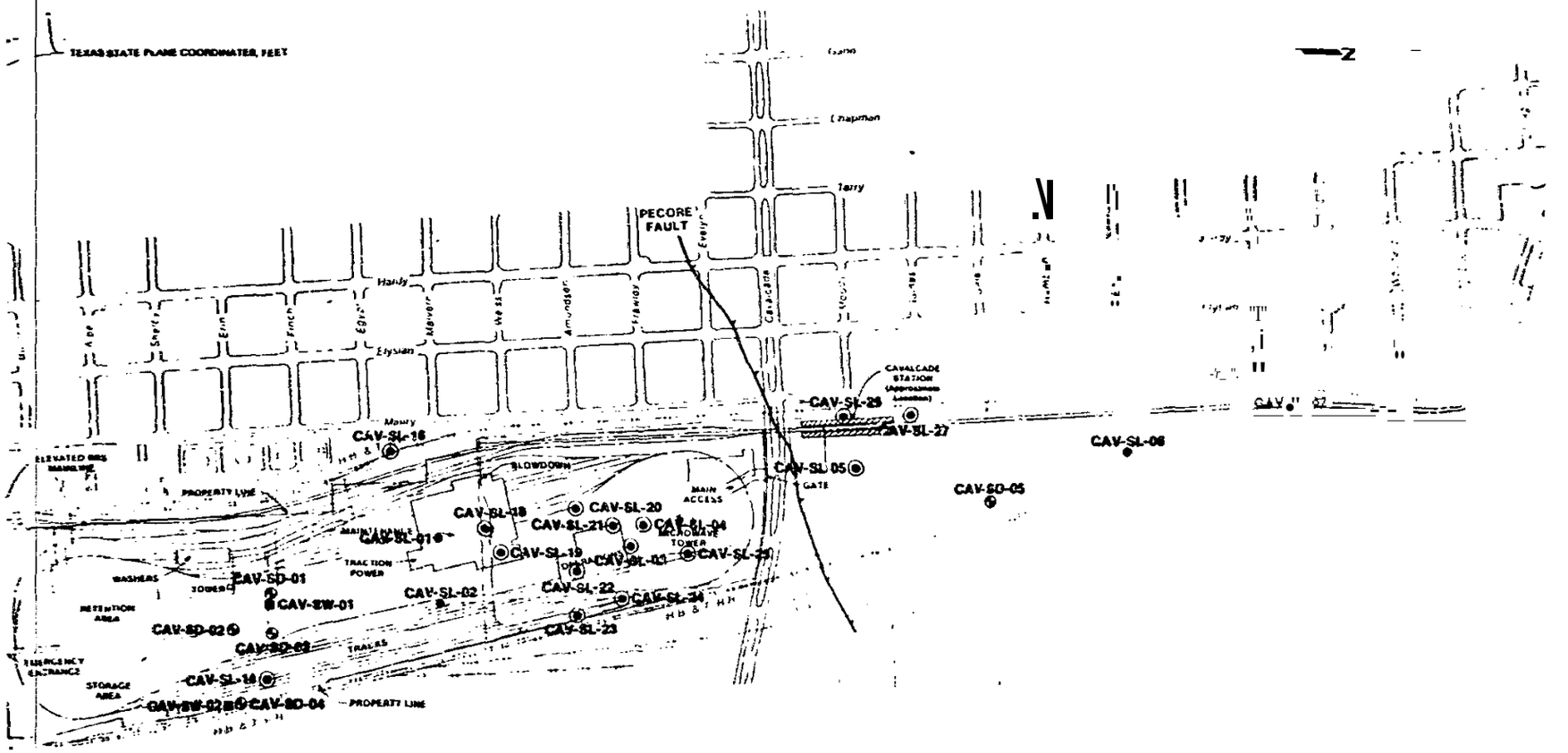
Full face respIrator with GMCH cartridges
Tyvek dIsposable coveralls
Taping of boots and gloves to reduce skin exposure
Disposable boot covers
head protectIon

The type and concentrations of contaminants encountered at this site do not require a greater level of personal protection. All onsile personnel have been subjected to str1ct health monitoring and professional instruction for field invetigation activities at uncontrolled hazardous waste sites. All field activities were coordir,ated by the COM Health and Safety officer, Mr. Donald Muldoon (C.I.h.).

An onsite health and safety monitoring person was also present to perform air monitoring and insure adherence to the plan. Adiscussion in greater detail, hazard information of chemicals associated at the site and specifieo activity requirement are contained in the Site Specific Health and Safety Sampling and Analytical for the Cavalcade Yard site. -

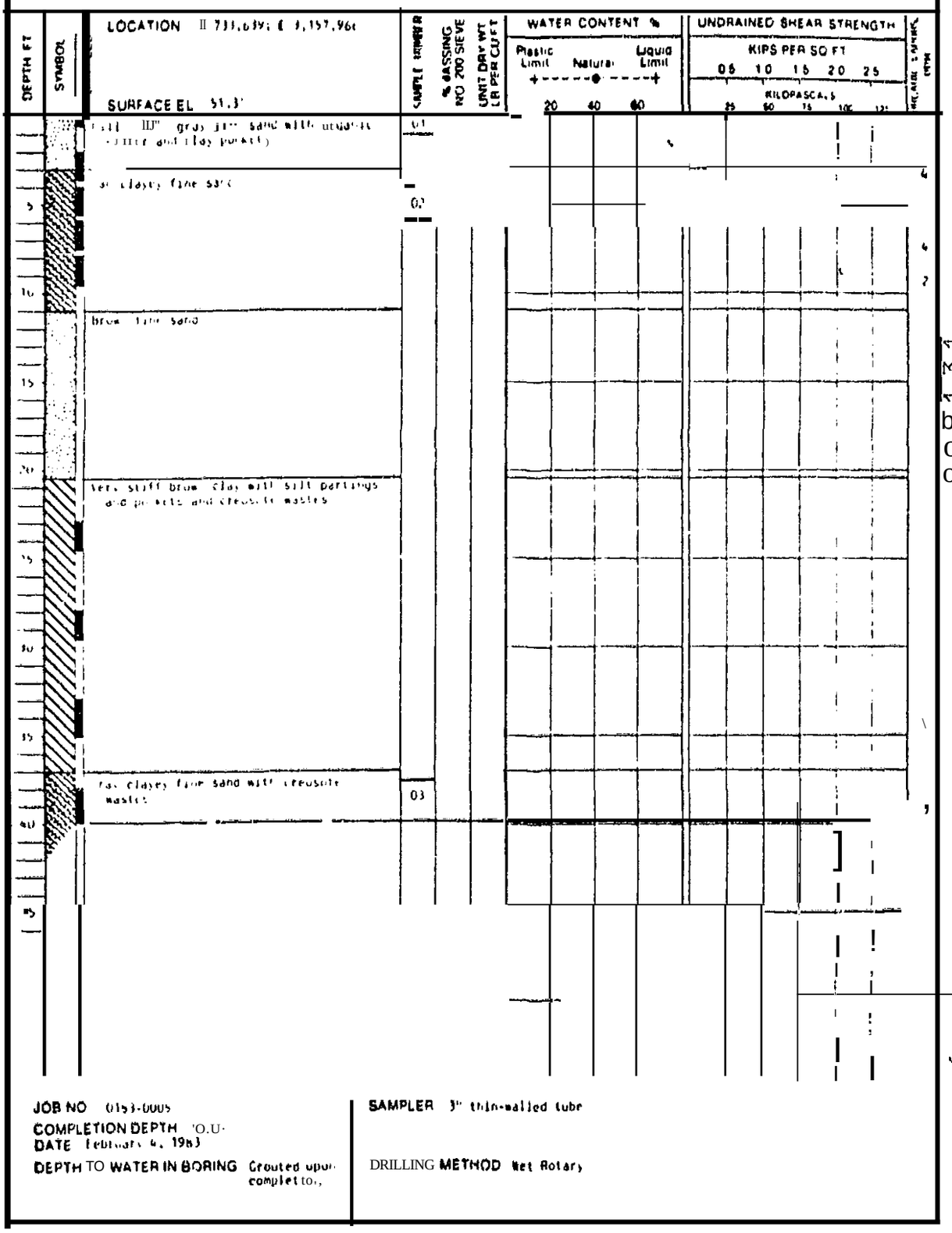
6.11 Elevation .and Horizontal Control

Ground surface elevations and sample locations were surveyed by Harsh/ Jalayer &Associates of Houston, Texas. All horizontal control is based on the lexas State Plane Coordinate System, South Central Zone, as establ ished by the National Geodetic Survey and the City of Houston. All vertical


TEXAS STATE PLANE COORDINATES, FEET
PECORE FAULT
Chapman
Terry
Hardy
Elysian
Maury
CAV-SL-16
CAV-SL-25
CAV-SL-27
CAV-SL-06
CAV-SL-05
CAV-SD-05
CAV-SL-18
CAV-SL-20
CAV-SL-21
CAV-SL-04
CAV-SL-01
CAV-SL-19
CAV-SL-03
CAV-SL-22
CAV-SL-24
CAV-SL-02
CAV-SD-01
CAV-EW-01
CAV-SD-02
CAV-SD-03
CAV-SL-23
CAV-SL-14
CAV-EW-02
CAV-SD-04
PROPERTY LINE
SLOWDOWN
MAIN ACCESS
GATE
WASHERS
TOILETS
TRACTION POWER
RETENTION AREA
STORAGE AREA
TRAILERS
CAV-SL-19
LEGEND:
Existing
Proposed
Drainage Swale
Deep Soil Sample
NOTES:
(1) Some proposed facilities not shown.
(2) Sample locations are approximate.
(3) Facility layout based on HTC Drawing No. CEP-1403 and 1404 dated April 28, 1983.
0
500

LOG OF BORING NO. CAV·SL·03

CAVALCADE CONTAMINANT SURVEY
METRO·STAGE ONE. REGIONAL RAIL SYSTEM
HOUSTON. TEXAS



JOB NO 0153-0005
COMPLETION DEPTH 'O.U·
DATE February 4, 1983
DEPTH TO WATER IN BORING Grouted upon completion

SAMPLER 3" thin-walled tube

DRILLING METHOD Wet Rotary

PLATE 6-2

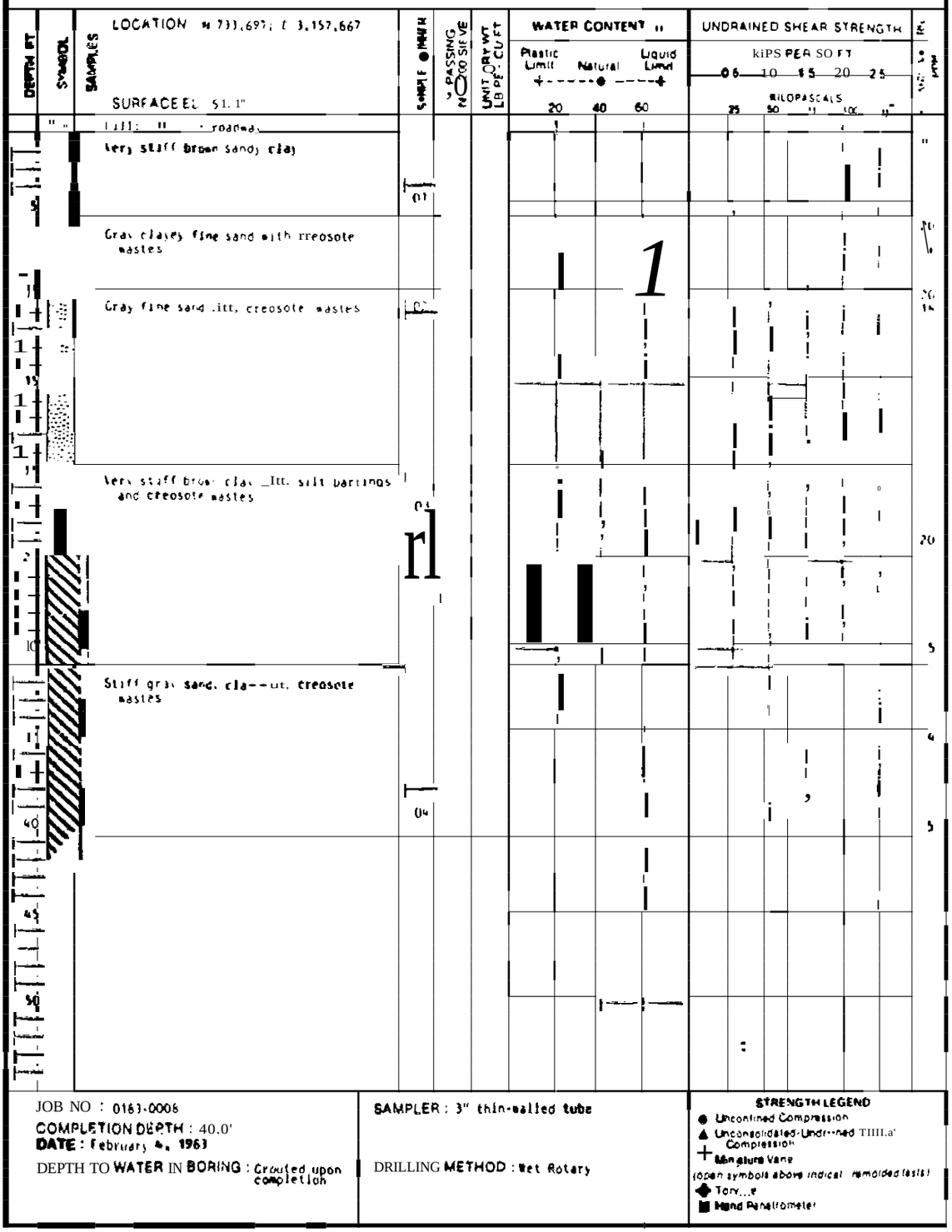
CAMPO-SEARS

131
boo

control and elevations are based on the National Geodetic Survey Mean Sea Level Datum, 1978 adJustment, as determined by its latest releveling (1981 projection) and as established by the National Geodetic Survey and the City of Houston. Location coordinates and ground surface elevations are given on the individual boring logs. All sample locations are summarized on Plate 6·51 for reference.

LOG OF BORING NO. CAV-SI-04

'CAVALCADE CONTAMINANT SURVEY
METRO-STAGE ONE. REGIONAL RAIL SYSTEM
HOUSTON. TEXAS



JOB NO : 0161-0006
COMPLETION DEPTH : 40.0'
DATE : February 4, 1963
DEPTH TO WATER IN BORING : Grouted upon completion

SAMPLER : 3" thin-walled tube
DRILLING METHOD : Wet Rotary

STRENGTH LEGEND
● Unconfined Compression
▲ Unconsolidated-Undrained Triaxial Compression
+ Miniature Vane
(Open symbols above indicate remolded tests)
◆ Torvane
■ Hand Penetrometer

MacCLELLAND ENGINEERS
CAMP DRESSER & McKEE

PLATE 6-3

000133

LOG OF BORING NO. CAV-Sl-OS

CAVALCADE CONTAMINANT **SURVEY**

METRO-STAGE ONE. REGIONAL RAIL SYSTEM

HOUSTON. TEXAS

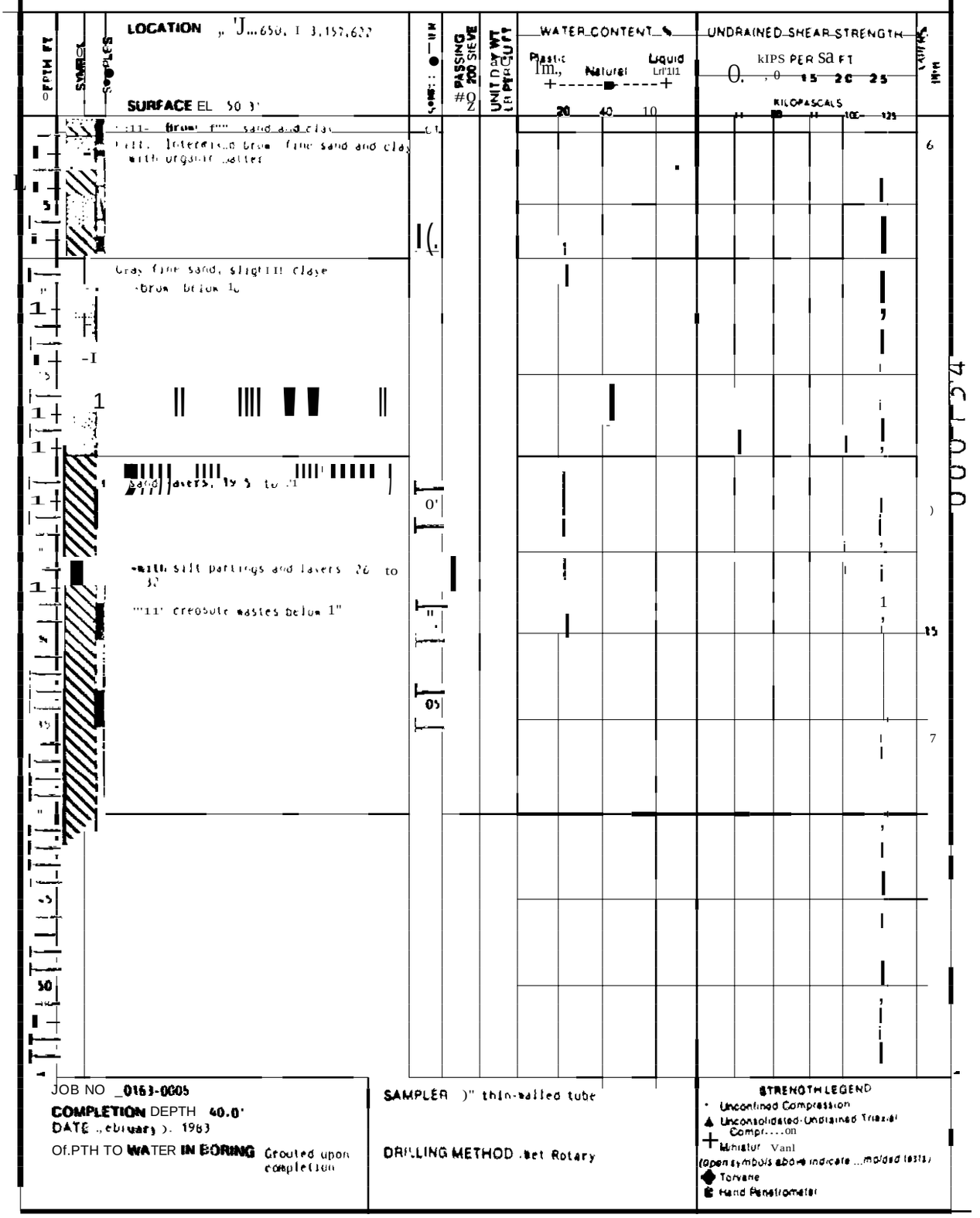


PLATE **6-4**

IOG OF BORING NO. CAV-SL-10

CAVALCADE CONTAMINANT SURVEY
METRO-STAGE ONE. REGIONAL RAIL SYSTEM
HOUSTON. TEXAS

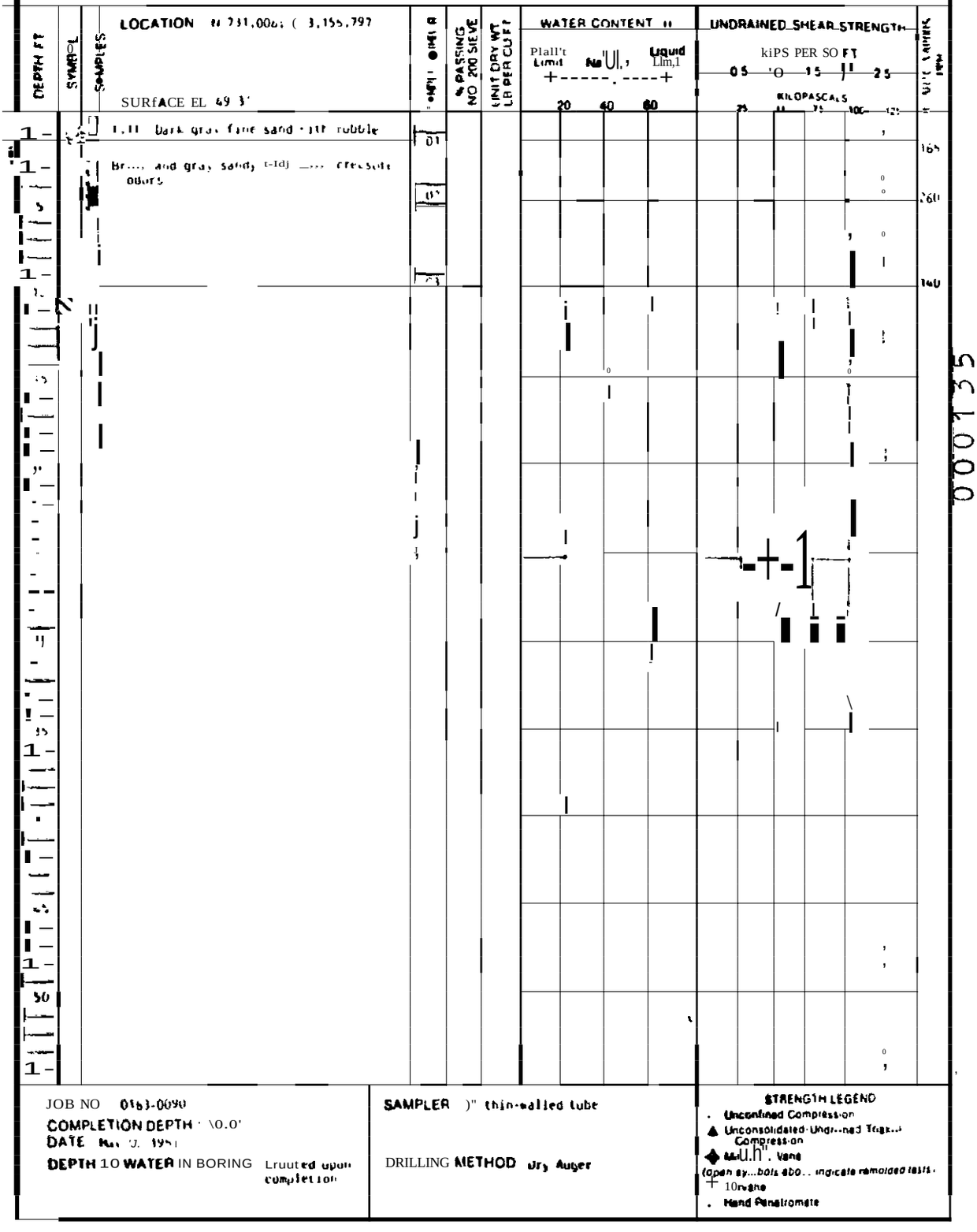
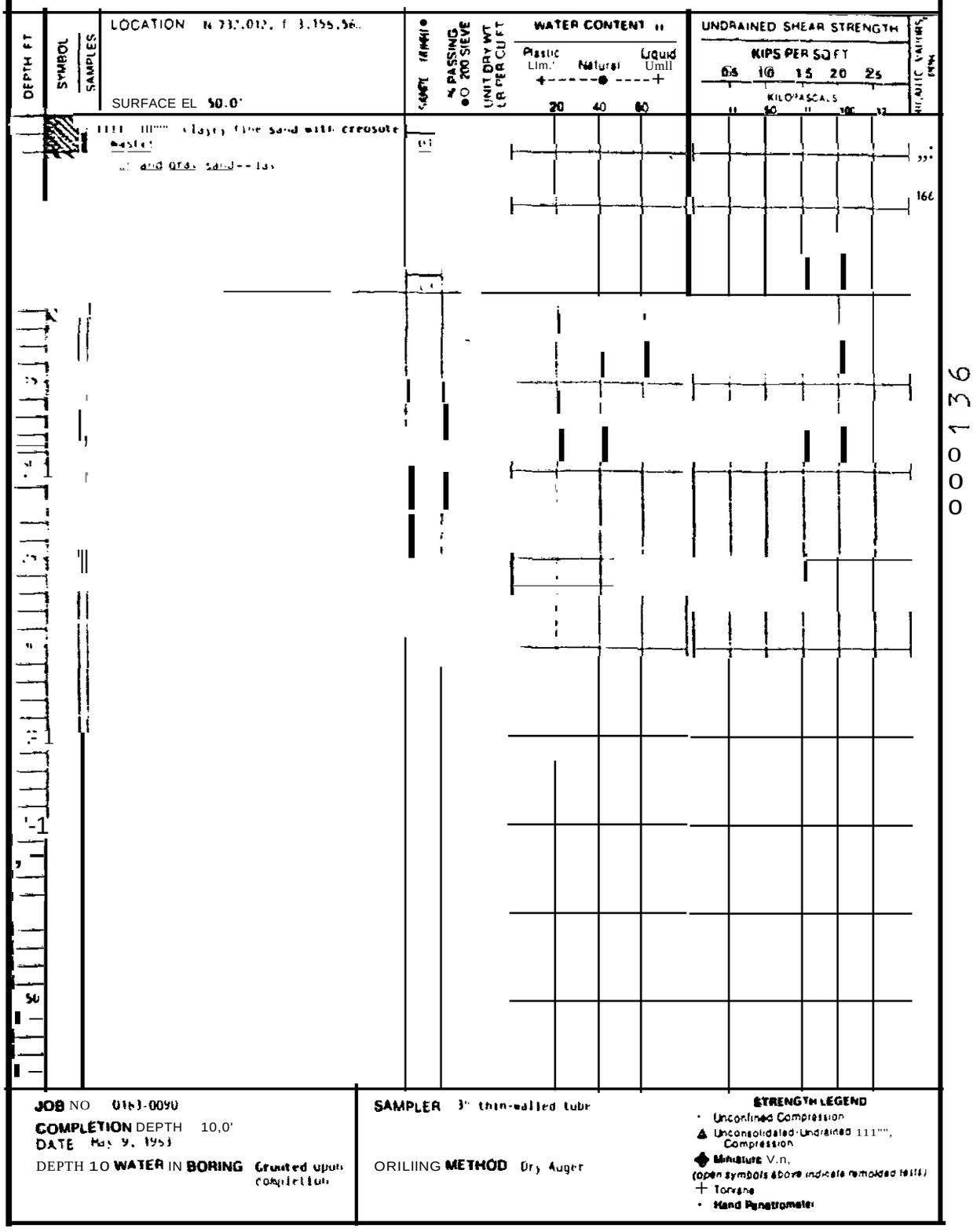


PLATE 6-5

LOG OF BORING NO. CAV-SL-14

CAVALCADE CONTAMINANT SURVEY
METRO-STAGE ONE, REGIONAL RAIL SYSTEM
HOUSTON, TEXAS



CAMP DRESSER & MCKEE

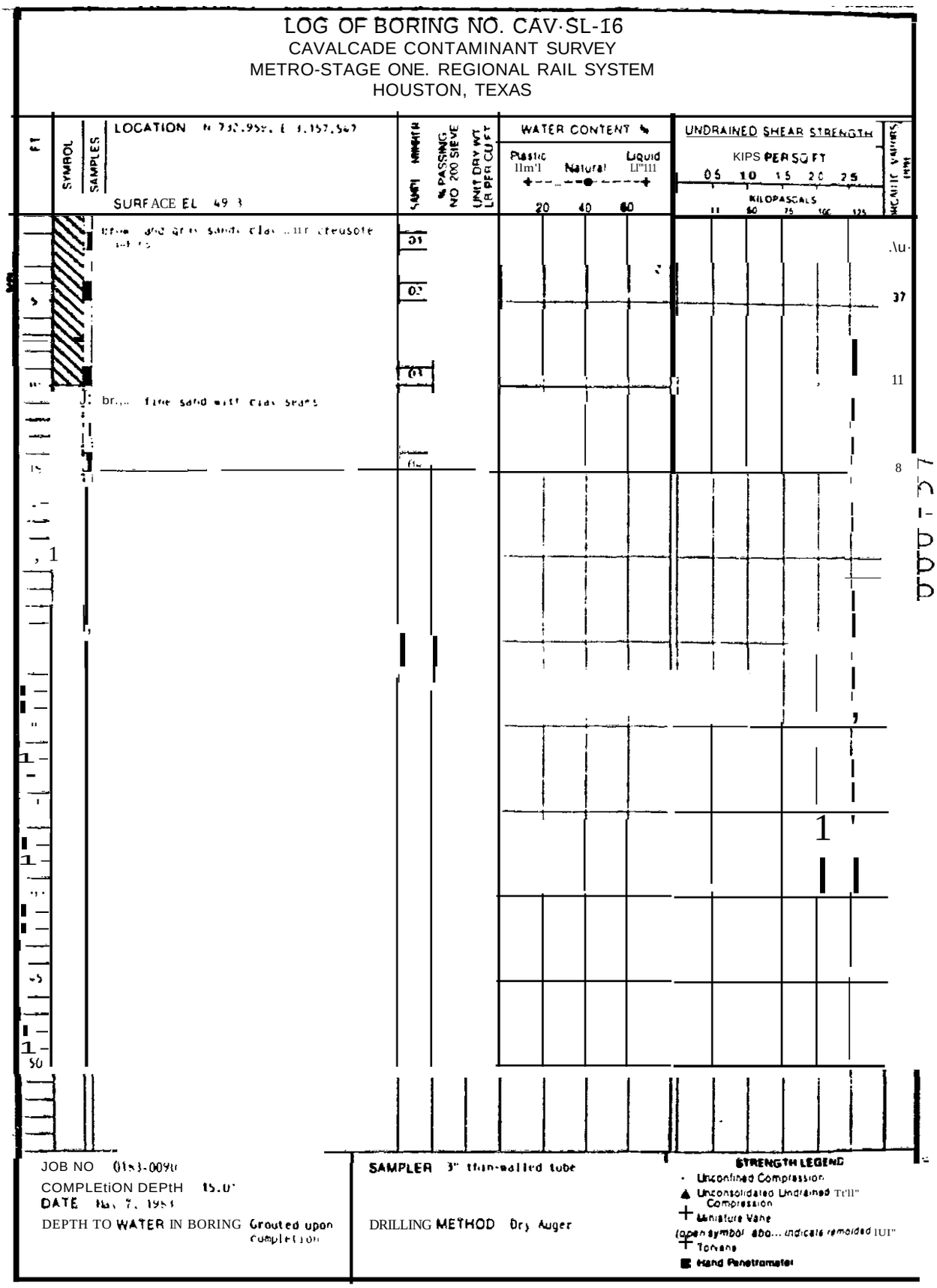
PLATE 6-6

000136

000136

LOG OF BORING NO. CAV-SL-16

CAVALCADE CONTAMINANT SURVEY
METRO-STAGE ONE. REGIONAL RAIL SYSTEM
HOUSTON, TEXAS



JOB NO 0183-0090
COMPLEtiON DEPtH 15.0'
DATE Nov 7, 1984
DEPTH TO WATER IN BORING Grouted upon completion

SAMPLER 3" thin-walled tube
DRILLING METHOD Dry Auger

STRENGTH LEGEND
- Unconfined Compression
- ▲ Unconsolidated Undrained Triil" Compression
- + Miniature Vane
- (open symbol also... indicals remolded IUI"
- + Torvane
- ■ Hand Penetrometer

PLATE 6-7

000137

LOG OF BORING NO. CAV·SL·18
CAVALCADE CONTAMINANT SURVEY
METRO·STAGE ONE. REGIONAL RAIL SYSTEM
HOUSTON. TEXAS

LOCATION N 712,974; E 3,157,959

SURFACE EL 50.1'

DEPTH FT	SYMBOL	SAMPLES	DESCRIPTION		PASSING NO 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT		KIPS PER SQ FT
			Brown and gray sandy clay						31
5									
			Brown fine sand						

PlUlle Llm'l — Natural — Liquid Limit: 20, 40, 60

KIPS PER SQ FT: 0.5, 1.0, 1.5, 2.0, 2.5

KILOPASCALS: 25, 50, 75, 100, 125

JOB NO 0151-0090
COMPLETION DEPTH. 15.0
DATE May 7, 1981
DEPTH TO WATER IN BORING Grouted upon completion

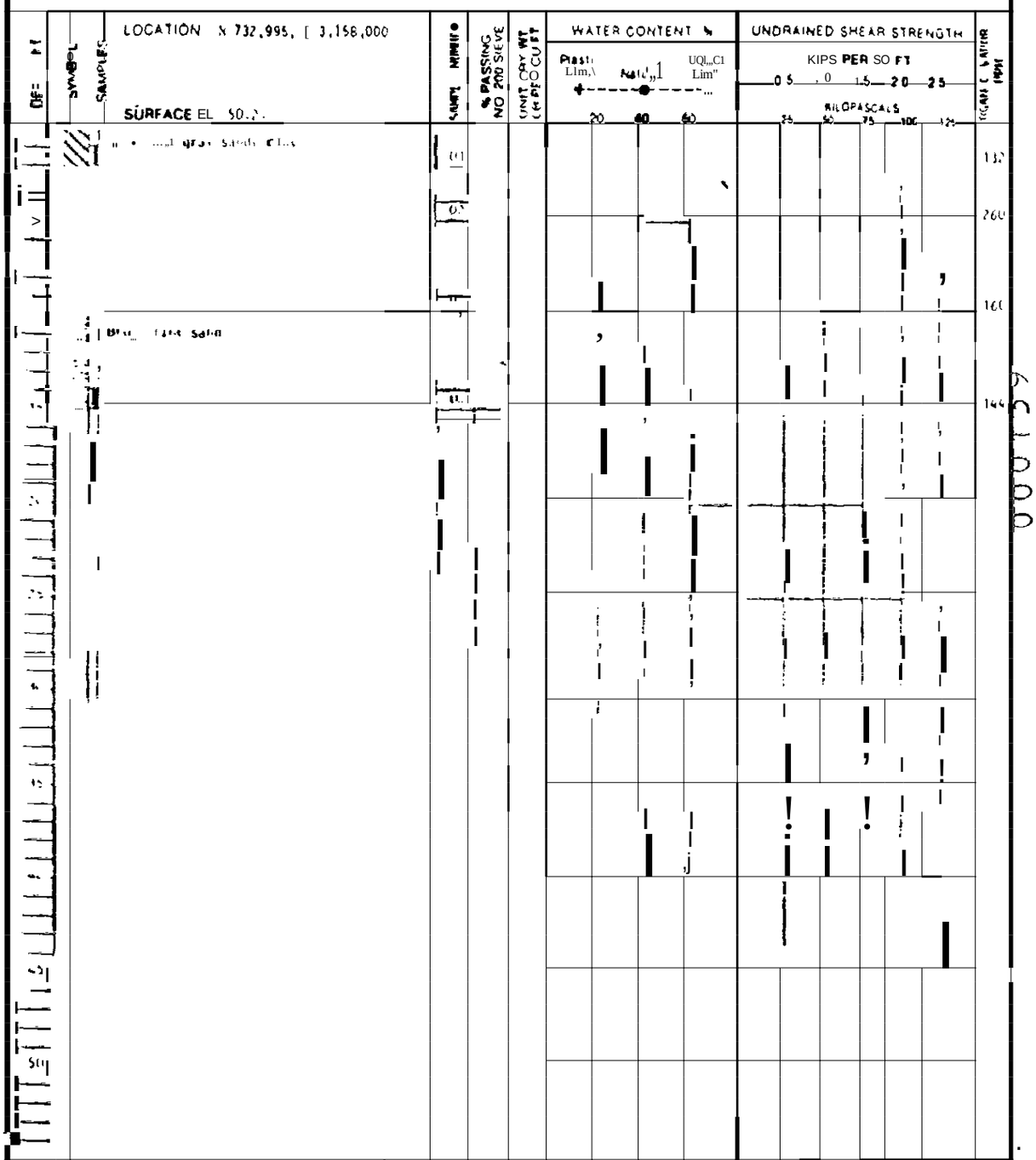
SAMPLER).. thin-walled tube
DRILLING METHOD Dry Auger

STRENGTH LEGEND
• Unconfined Compression
▲ Unconsolidated-Undrained Triaxial Compression
◆ Miniature Vane
Open symbols above indicate remolded tests
✚ Torvane
■ Hand Penetrometer

PLATE 6-8

lOG OF BORING NO. CAV.SL.19

CAVALCADE CONTAMINANT SURVEY
METRO-STAGE ONE, REGIONAL RAIL SYSTEM
HOUSTON, **TEXAS**



JOB NO 6151-0090
COMPLETION DEPTH 15.0'
DATE May 9, 1985
DEPTH TO **WATER** IN BORING Grouted upon complet 101.

SAMPLER .)" **thin-walled tube**

DRILLING METHOD . Or) Auger

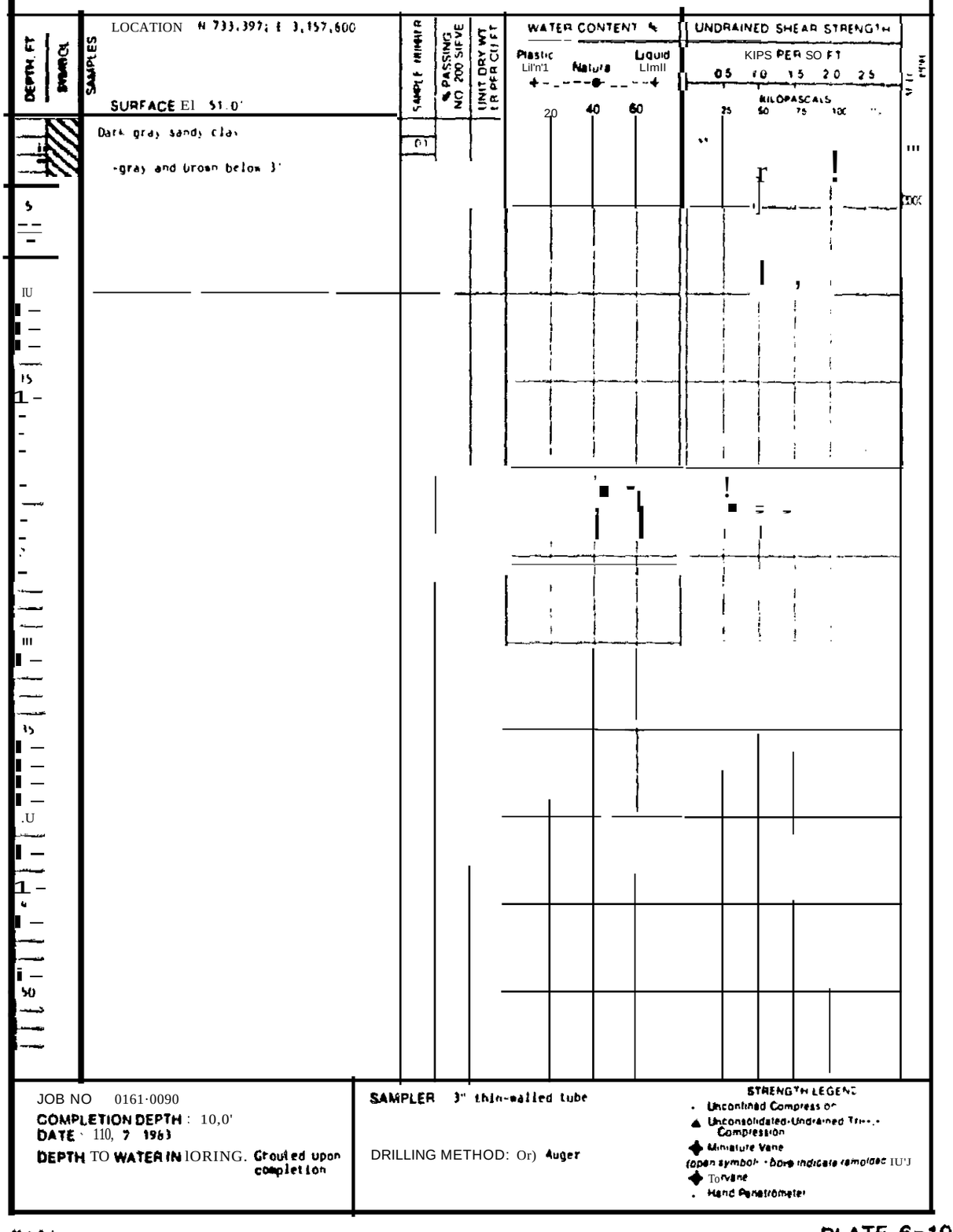
STRENGTH LEGEND
- Unconfined Compression
- Unconsolidated-Undrained Triaxial Compression
- Miniature Vane
(open symbols above indicate remolded tests)
- Torvane
- Hand Penetrometer

PLATE **6-9**

000139

LOG OF BORING NO. CAV·SL-20

CAVALCADE CONTAMINANT SURVEY
METRO-STAGE ONE. REGIONAL RAIL SYSTEM
HOUSTON. TEXAS



JOB NO 0161·0090
COMPLETION DEPTH : 10,0'
DATE · 110, 7 1963
DEPTH TO WATER IN IORING. Grouted upon completion

SAMPLER 3" thin-walled tube

DRILLING METHOD: Or) Auger

STRENGTH LEGEND
- Unconfined Compression
- Unconsolidated-Undrained Triaxial Compression
- Miniature Vane (open symbol - bore indicate remolded IU'J
- Torvane
- Hand Penetrometer

PLATE 6-10

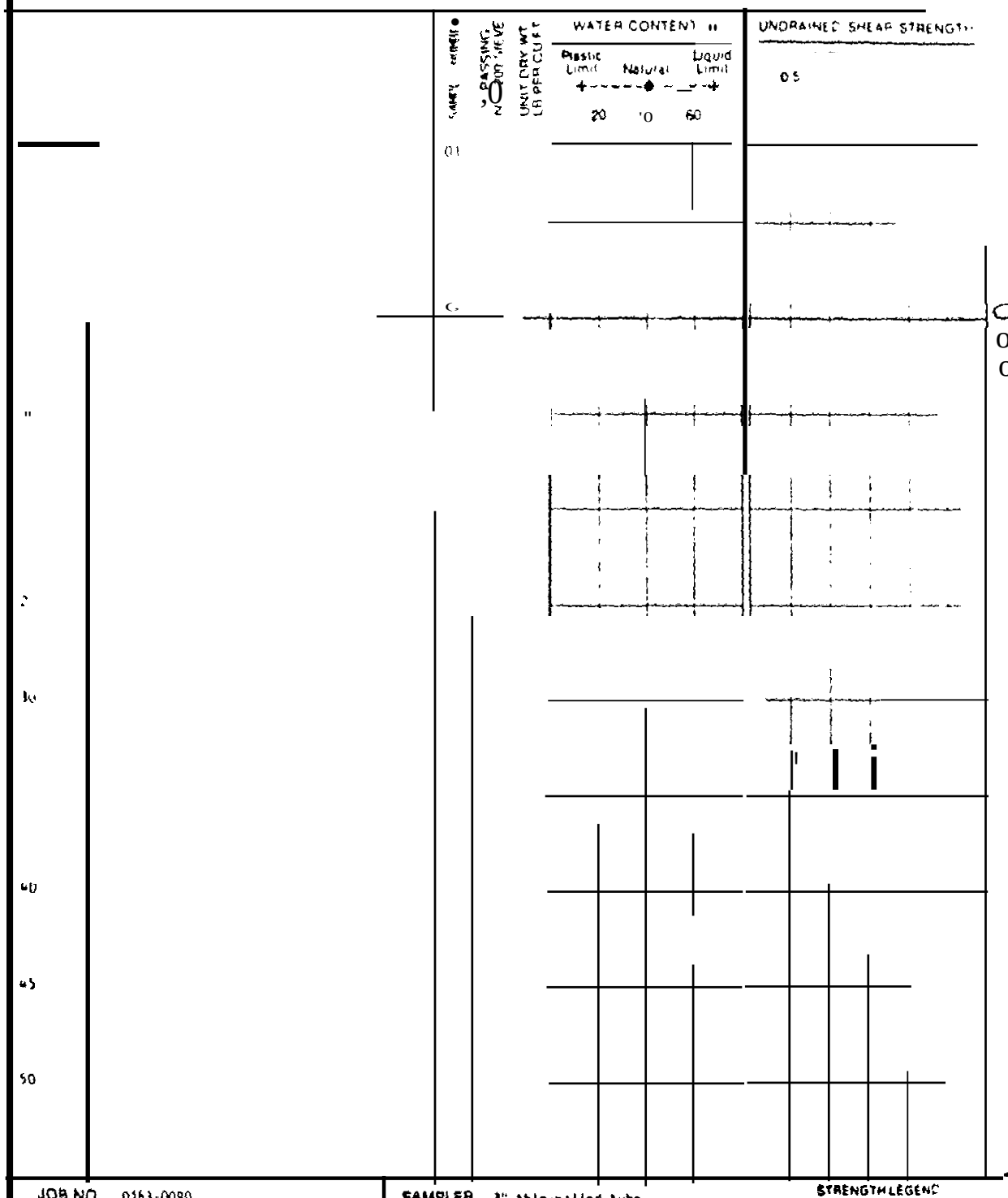
000140

LOG OF BORING NO. CAV-SL-21

CAVALCADE CONTAMINANT SURVEY

METRO-STAGE ONE, REGIONAL RAIL SYSTEM

HOUSTON, TEXAS



JOB NO 0163-0090

COMPLETION DEPTH : 10.0'

DATE : May 11, 1983

DEPTH TO WATER IN BORING : Grouted upon completion

SAMPLER : 3" thin-walled tube

DRILLING METHOD : Or, Auger

STRENGTH LEGEND

- Unconfined Compression
- Unconsolidated-Undrained Triaxial Compression
- Miniature V
- Torvane

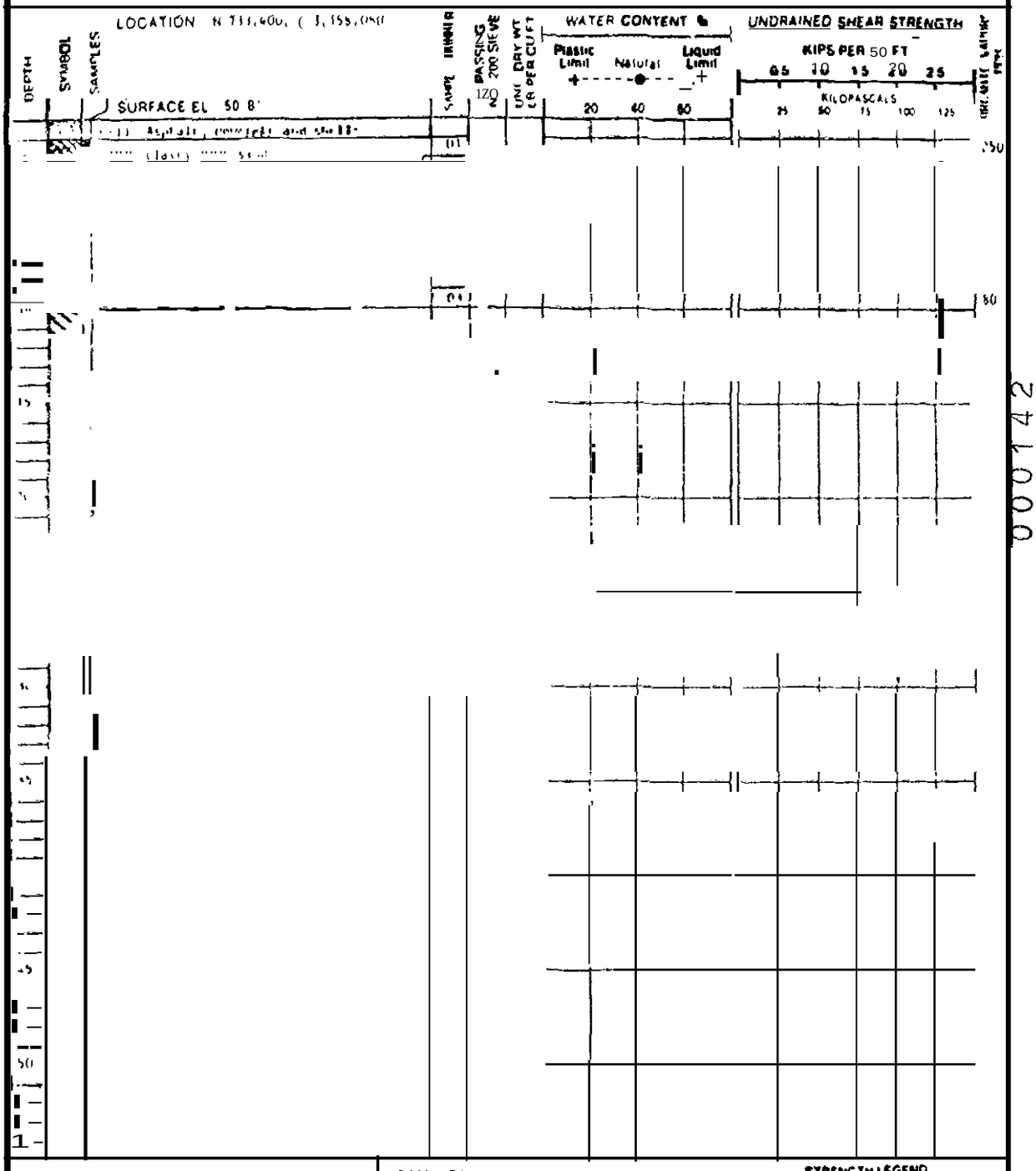
(open symbols above indicate remolded tests)

LOG OF BORING NO. CAV-SL'22

CAVALCADE CONTAMINANT SURVEY

METRO-STAGE ONE. REGIONAL RAIL **SYSTEM**

HOUSTON. **TEXAS**



CAMP DRESSER & MCKEE

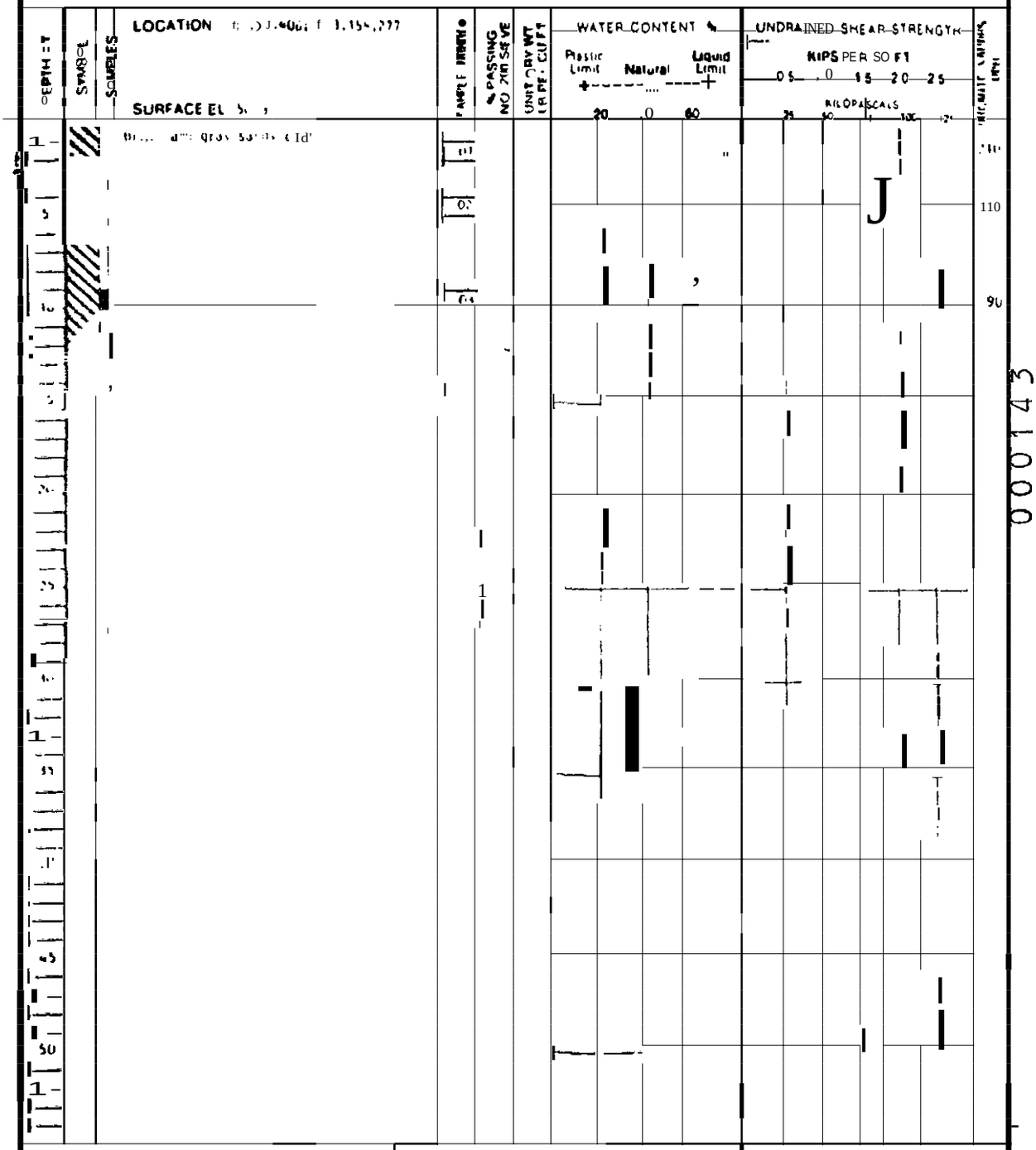
PLATE **6-12**

000142

000142

LOG OF BORING NO. CAV-SL-23

CAVALCADE CONTAMINANT SURVEY
METRO-STAGE ONE. REGIONAL RAIL SYSTEM
HOUSTON, TEXAS



JOII NO 0153-0090
COMPLETION OEPTH 10.U'
DATE
OErTH 10 WATER IN BORING Ctouted utJOI' completion

SAMPLER 3" thin-walled tube

DRILLING METHOD Dry Auger

STRENGTH LEGEND
- Unconfined Compression
- Unconsolidated-Undrained Triaxial Compression
- Miniature Vane
(open symbols above indicate remolded tests)
- Torvane
- Hand Penetrometer

PLATE 6-13

000143

000143

LOG OF BORING NO, CAV·SL·24
CAVALCADE CONTAMINANT SURVEY
METRO-STAGE ONE. REGIONAL RAIL SYSTEM
HOUSTON, TEXAS

LOCATION N 731,600, E 3,155,720

SURFACE EL 50.7'

DEPTH FT	SYMBOL	SAMPLES	DESCRIPTION	SAMPLE NUMBER	PASSING NO 200 SIEVE	UNIT DRY WT. LB PER CU FT	WATER CONTENT % (Plastic Limit / Natural / Liquid Limit) 20 40 60	UNDRAINED SHEAR STRENGTH KIPS PER SQ FT 0.5 1.0 1.5 2.0 2.5 (KILOPASCALS 25 50 75 100 125)
			[illegible] gray sandy clay					
50								

JOB NO 0153-0090
COMPLETION DEPTH 10.0 ft.
DATE May 9, 1984
DEPTH TO WATER IN BORING Grouted upon completion

SAMPLER 3" thin-walled tube
DRILLING METHOD Dry Auger

STRENGTH LEGEND
- Unconfined Compression
- ▲ Unconsolidated-Undrained Triaxial Compression
- + Miniature Vane
- (open symbols above indicate remolded tests)
- ◆ Torvane
- • Hand Penetrometer

PLATE 6-14

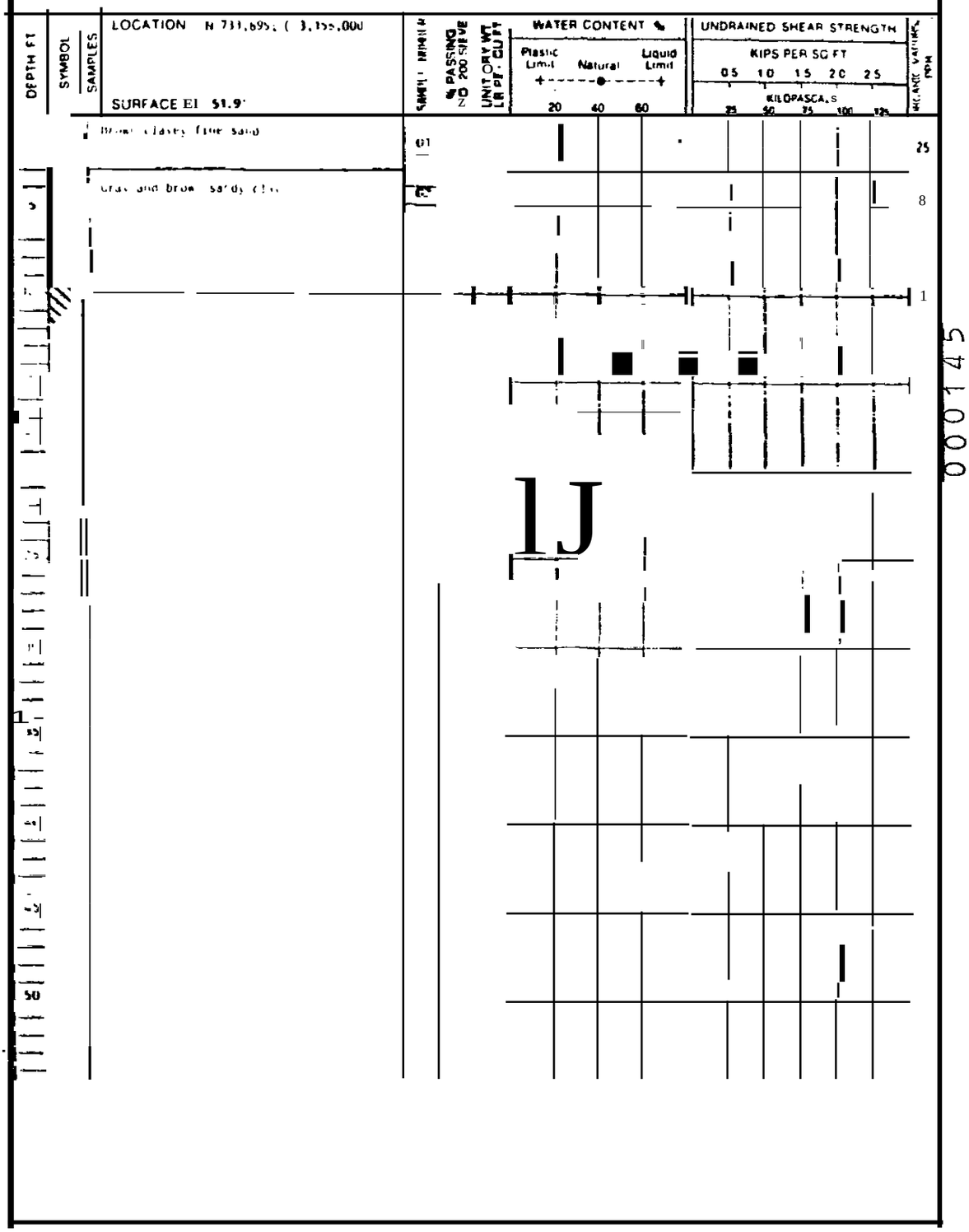
000144

LOG OF BORING NO. CAV-SL-25

CAVALCADE CONTAMINANT **SURVEY**

METRO-STAGE ONE. REGIONAL RAIL SYSTEM

HOUSTON. TEXAS



000145

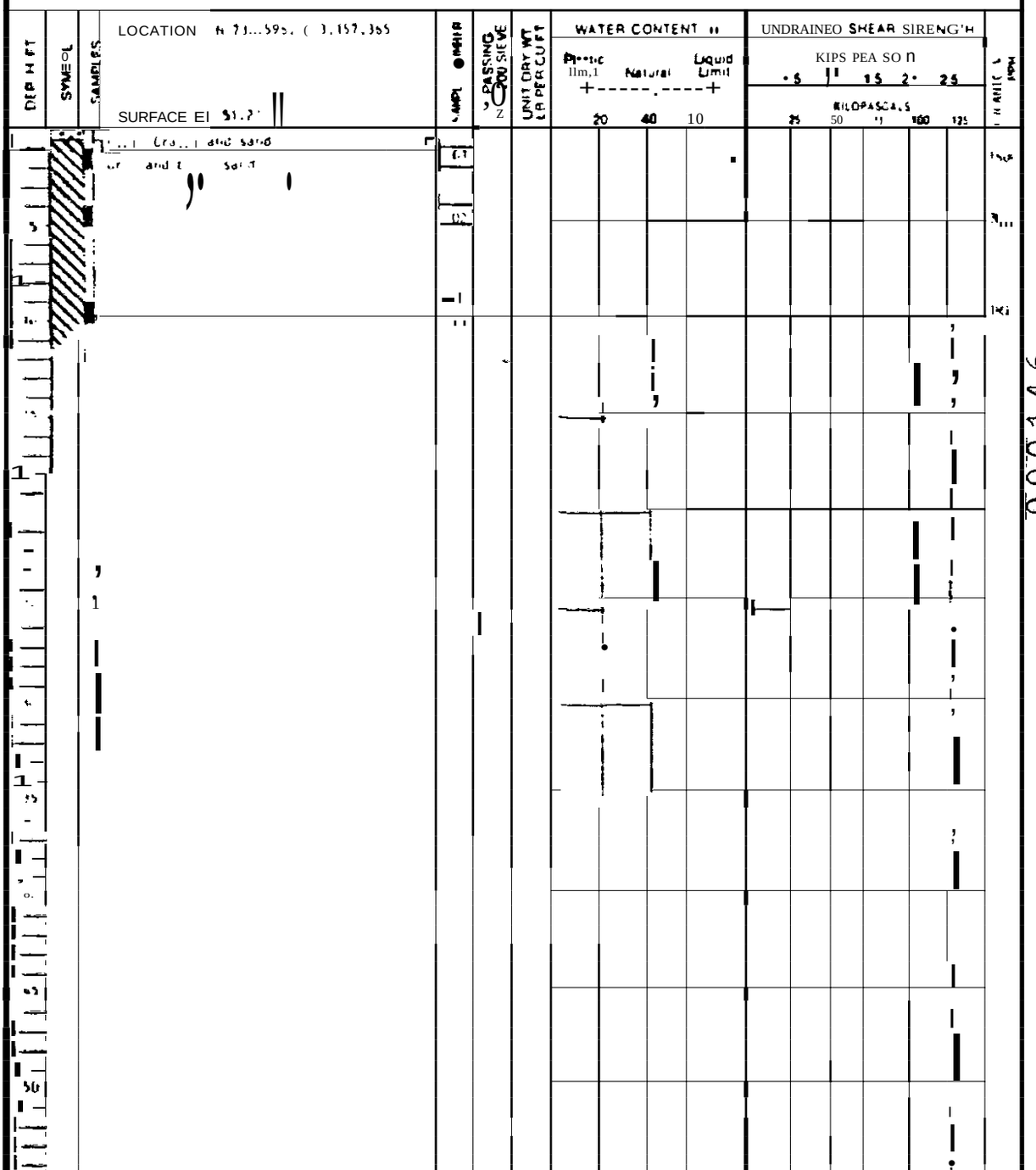
PLATE 6-15

LOG OF BORING NO. CAV·SL·26

CAVALCADE CONTAMINANT SURVEY

METRO-STAGE ONE. REGIONAL RAIL SYSTEM

HOUSTON, TEXAS



JOB NO 0183-00(9

COMPLETION DEPTH to.(•

DATE May '1. 1953

DEPTH to WATER IN BORING Grouted upon completion

SAMPLER)0' thin-walled tube

DRILLING METHOD Dry Auger

STRENGTH LEGEND

- Unconfined Compression
- ▲ Unconsolidated-Undrained t,....., Compression
- + Miniature Vane

(open symbols above indicate remolded tests)

- + Torvane
- • Hand Penetrometer

PLATE 6-H

000146

000146

LOG OF BORING NO. CAV-SL-27

CAVALCADE CONTAMINANT SURVEY
METRO-STAGE ONE. REGIONAL RAIL SYSTEM
HOUSTON. TEXAS

LOCATION N 734,900, [3,157.J18

SURFACE El 50.9'

DEPTH FT	SYMBOL	SAMPLES	DESCRIPTION	SAMPLE NUMBER	% PASSING NO. 200 SIEVE	UNIT DRY WT LB PER CU FT	WATER CONTENT % (Plastic Limit / Natural / Liquid Limit; 20 40 60)	UNDRAINED SHEAR STRENGTH KIPS PER SQ FT (0.5 1.0 1.5 2.0 2.5)
			Fill: Gravel and dark gray sand, clay					
			Gray and brown, sandy clay					
5								

10

15

35

40

45

50

JOB NO 0163-0050
COMPLETION DEPTH 10.0'
DATE 1953
DEPTH TO WATER IN BORING: Groute upon completion

SAMPLER Thin-walled tube
DRILLING METHOD Dry Auger

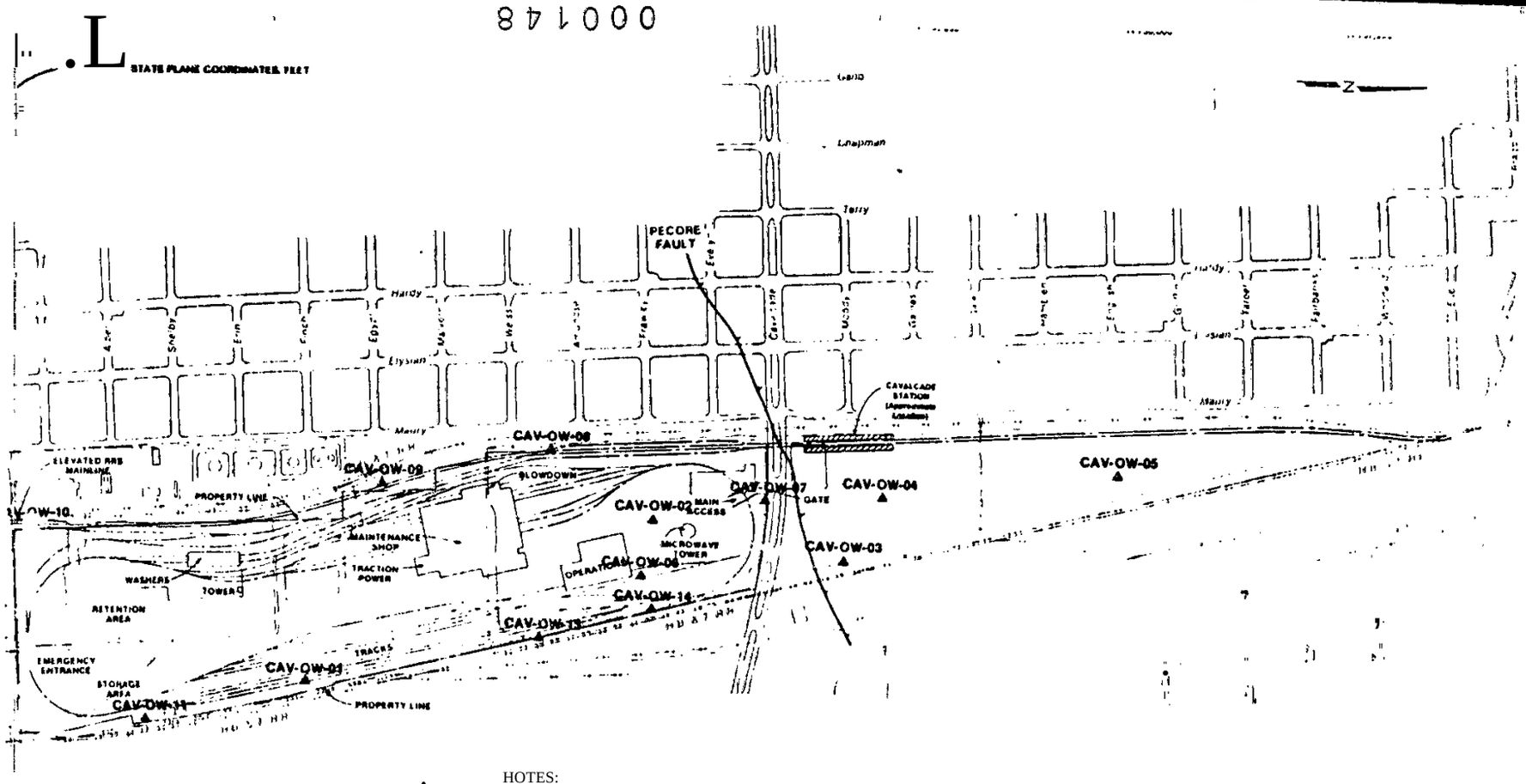
STRENGTH LEGEND
• Unconfined Compression
▲ Unconsolidated-Undrained Triaxial Compression
+ Field Vane
(open symbols also indicate remolded test)
+ Torvane
• Hand Penetrometer

PLATE 6-17

000147

000148

STATE PLANE COORDINATES, FEET



UbENO:

- Existing
- Proposed
- Drainage Swale
- Observation Well

HOTES:

(1) Some proposed facilities not shown
(2) Boring locallons.r. apprO.lmll..
13) Facility layout based on HTC 0rawing No. CEP-1403 and 1404 dated April 28, 1983

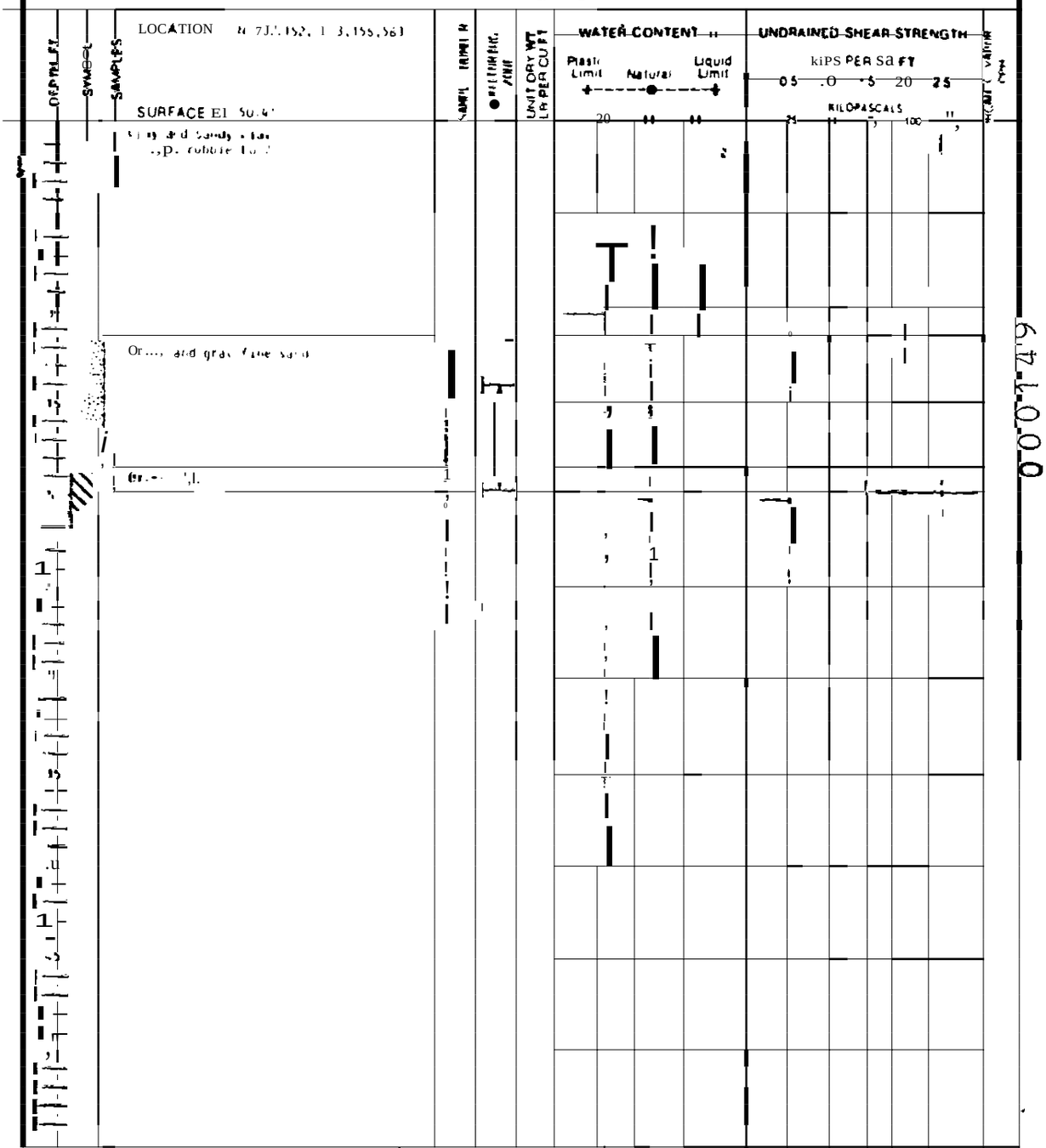
0 500 1000 Feet

lOG OF BORING NO. CAV-OW-01

CAVALCADE CONTAMINANT SURVEY

METRO-STAGE ONE REGIONAL RAIL SYSTEM

HOUSTON. **TEXAS**



JOB NO 0153-0006

COMPLETION DEPTH 19.5'

DATE II...uary 7- 19...

DEPTH 10 WATER IN BORING 0.4'

DATE Ma, t7. 195)

SAMPLER No samples taken

DRILLING METHOD Wet Rotary

STRENGTH LEGEND

- Unconfined Compression
- Unconsolidated-Undrained Compr.... ss
- Miniature Vane

(open symbols sho... indicate remolded tests)

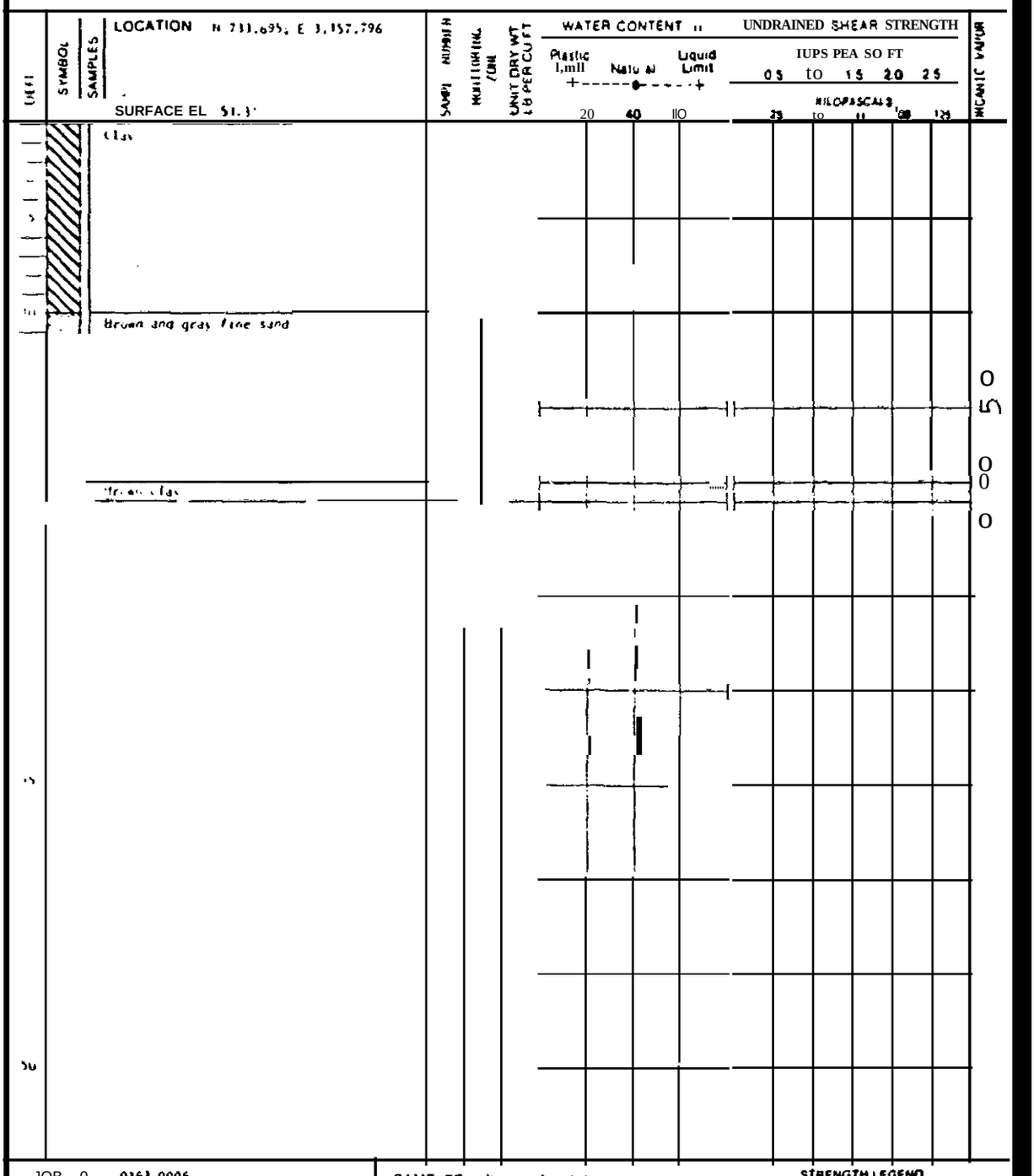
- Torvane
- Hand Penetrometer

PLATE **6-1!**

000149

LOG OF BORING NO. CAV-OW-02

CAVALCADE CONTAMINANT SURVEY
METRO-STAGE ONE, REGIONAL RAIL SYSTEM
HOUSTON, TEXAS



JOB ..0 0163-0005
COMPLETION DEPTH 20.0'
DATE February 5, 1983
DEPTH TO WATER IN BORING 5.4'
DATE. May 17, 1983

SAMPLER No samples taken

DRILLING METHOD Wet Rotary

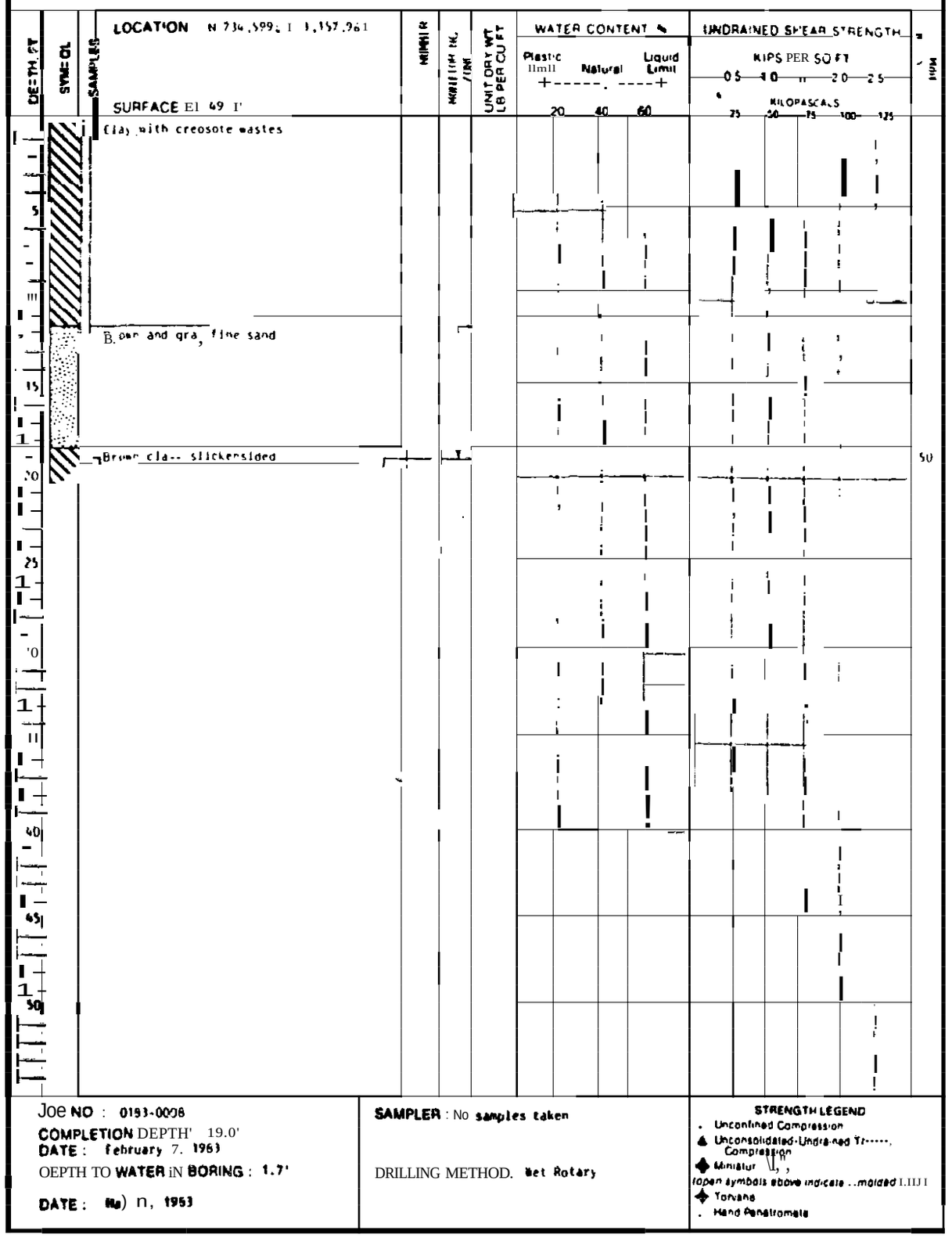
STRENGTH LEGEND
- Unconfined Compression
- Unconsolidated-Undrained Triaxial Compression
- Miniature Vane
(open symbols above indicate remolded strength)
- Torvane
- Hand Penetrometer

CAMPBELL & ASSOCIATES

PLATE 6-2

LOG OF BORING NO. CAV·OW-03

CAVALCADE CONTAMINANT SURVEY
METRO-STAGE ONE. REGIONAL **RAIL** SYSTEM
HOUSTON. TEXAS



Joe NO : 0193-0008
COMPLETION DEPTH' 19.0'
DATE : February 7. 1963
OEPTH TO WATER iN BORING : 1.7'
DATE : Ma) n, 1953

SAMPLER : No samples taken

DRILLING METHOD. Wet Rotary

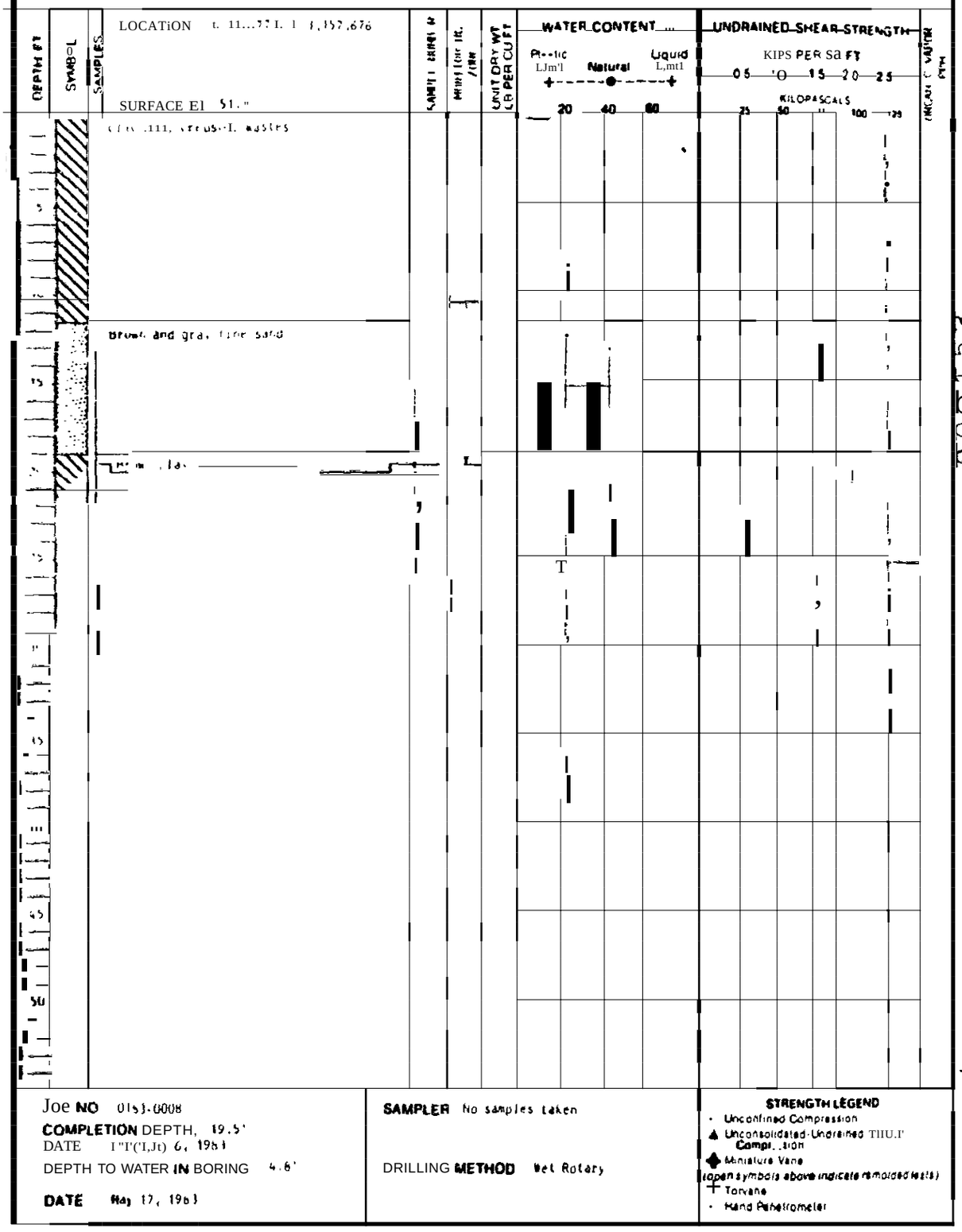
STRENGTH LEGEND
- Unconfined Compression
- Unconsolidated-Undrained Tr·····, Compression
- Miniatur
- (open symbols above indicate ..molded
- Torvane
- Hand Penetrometa

PLATE 6-21

000151

LOG OF BORING NO. CAV·OW·04

CAVALCADE **CONTAMINANT** SURVEY
METRO-STAGE ONE. REGIONAL RAIL SYSTEM
HOUSTON. TEXAS



Joe NO 0153-0008
COMPLETION DEPTH, 19.5'
DATE 1"I'(I,Jt) 6, 1963
DEPTH TO WATER IN BORING 4.6'
DATE May 17, 1963

SAMPLER No samples taken

DRILLING **METHOD** Wet Rotary

STRENGTH LEGEND
- Unconfined Compression
- Unconsolidated-Undrained TIIU.I' Compression
- Miniature Vane
(open symbols above indicate remolded tests)
- Torvane
- Hand Penetrometer

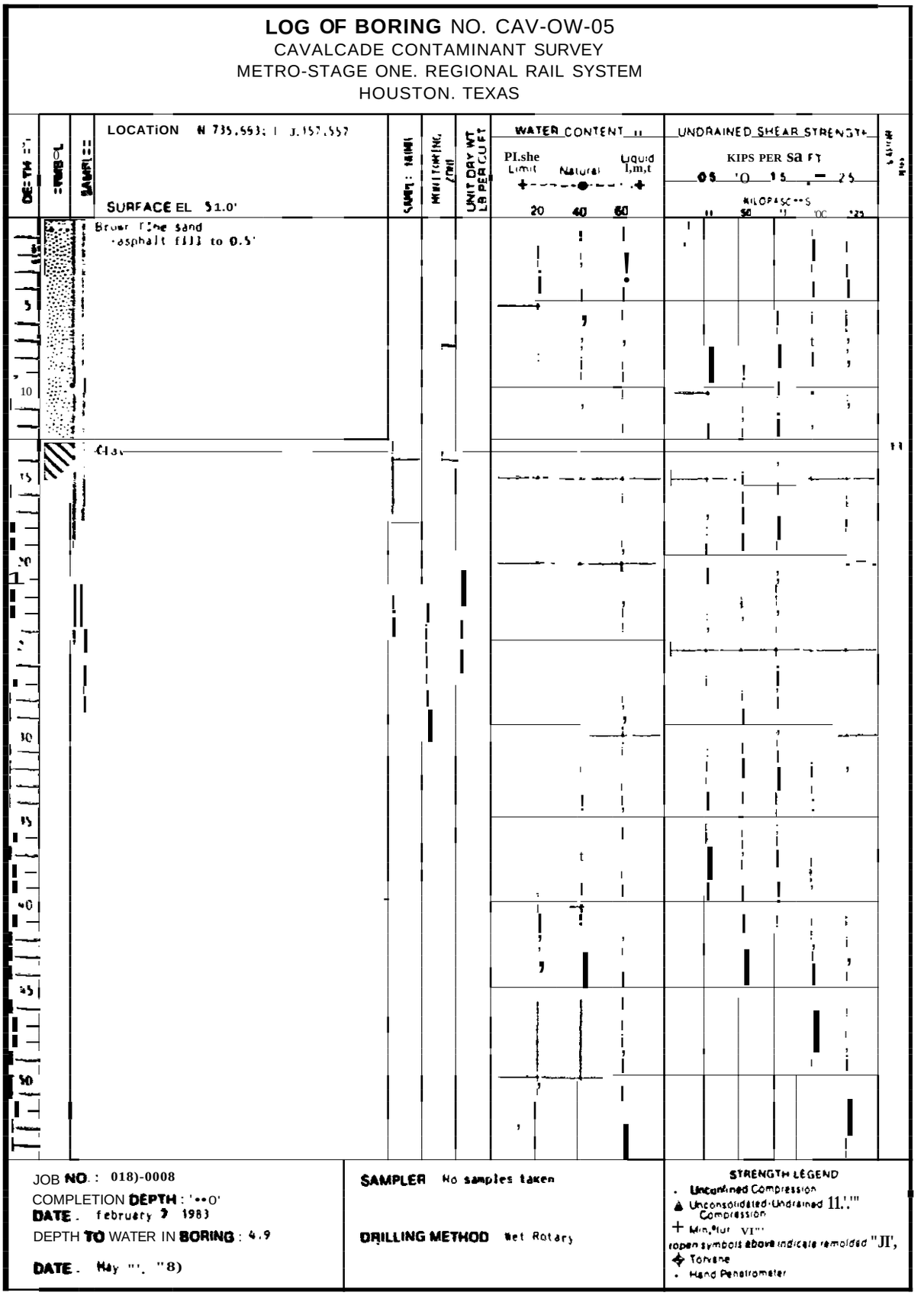
PLATE6-22

000152

000152

LOG OF BORING NO. CAV-OW-05

CAVALCADE CONTAMINANT SURVEY
METRO-STAGE ONE. REGIONAL RAIL SYSTEM
HOUSTON. TEXAS



JOB NO. : 018)-0008
COMPLETION DEPTH : '••0'
DATE . february 7 1983
DEPTH TO WATER IN BORING : 4.9
DATE . May "'. "8)

SAMPLER No samples taken

DRILLING METHOD Wet Rotary

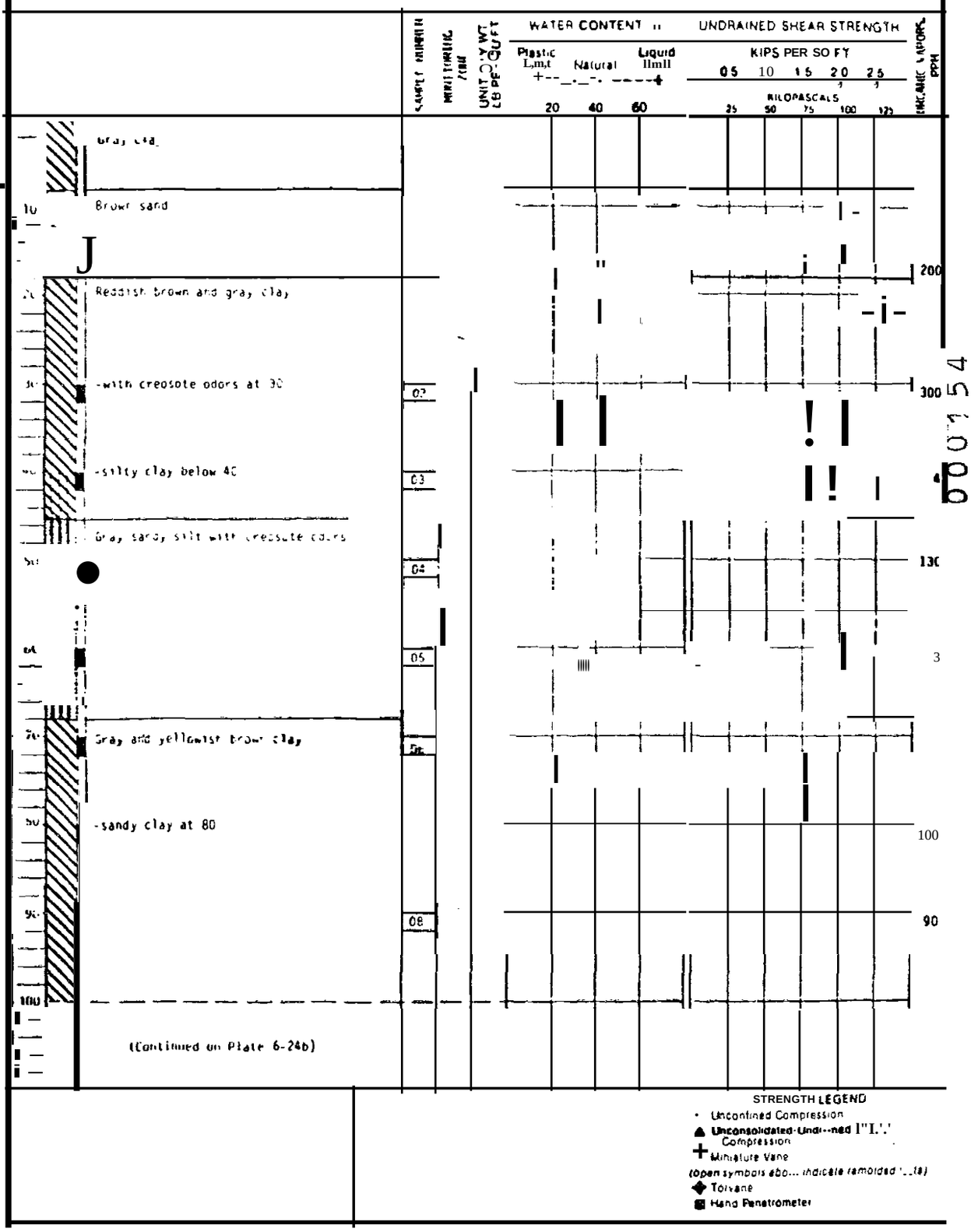
STRENGTH LEGEND
• Unconfined Compression
▲ Unconsolidated-Undrained Compression
+ Vane
(open symbols above indicate remolded)
◆ Torvane
• Hand Penetrometer

PLATE 6-23

000153

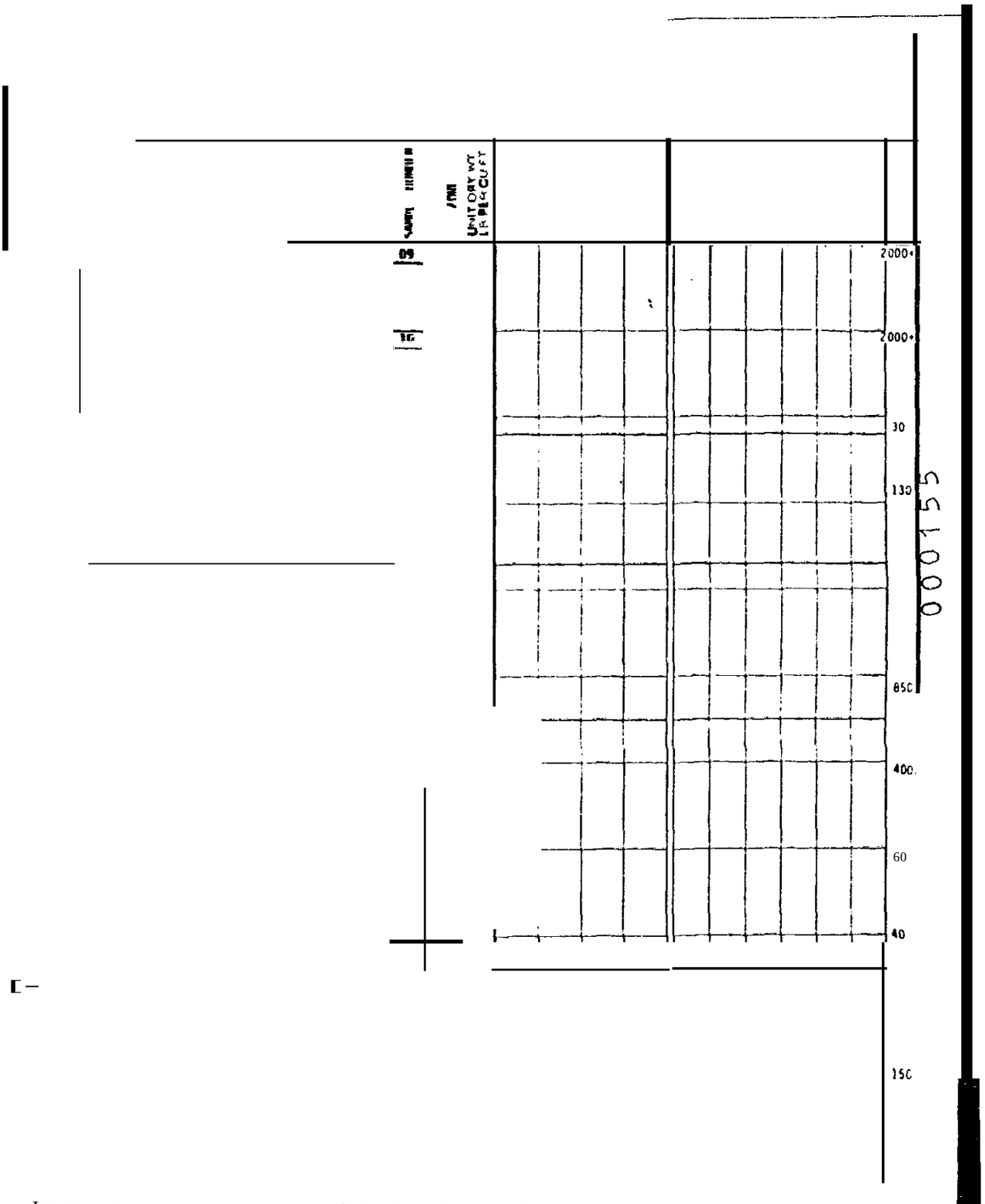
LOG OF BORING NO. CAV-OW-06

CAVALCADE CONTAMINANT SURVEY
METRO-STAGE ONE, REGIONAL RAIL SYSTEM
HOUSTON. TeXAS



UNDERGROUND RESOURCE MANANGEMENT
CAMP DRESSER & MCKEE

PLATE 6-24



Joe NO 0183-0090
COMPLETION DEPTH 210.0'
DATE Ma, 11, 1983

SAMPLER 3" thin-walled tube

DRILLING METHQO Wet rotary

- Unconfined Compression
- Unconsolidated Undrained Triaxial Compression
- Miniature Vane
(open symbols above indicate remolded tests)
- Torvane
- Hand Penetrometer

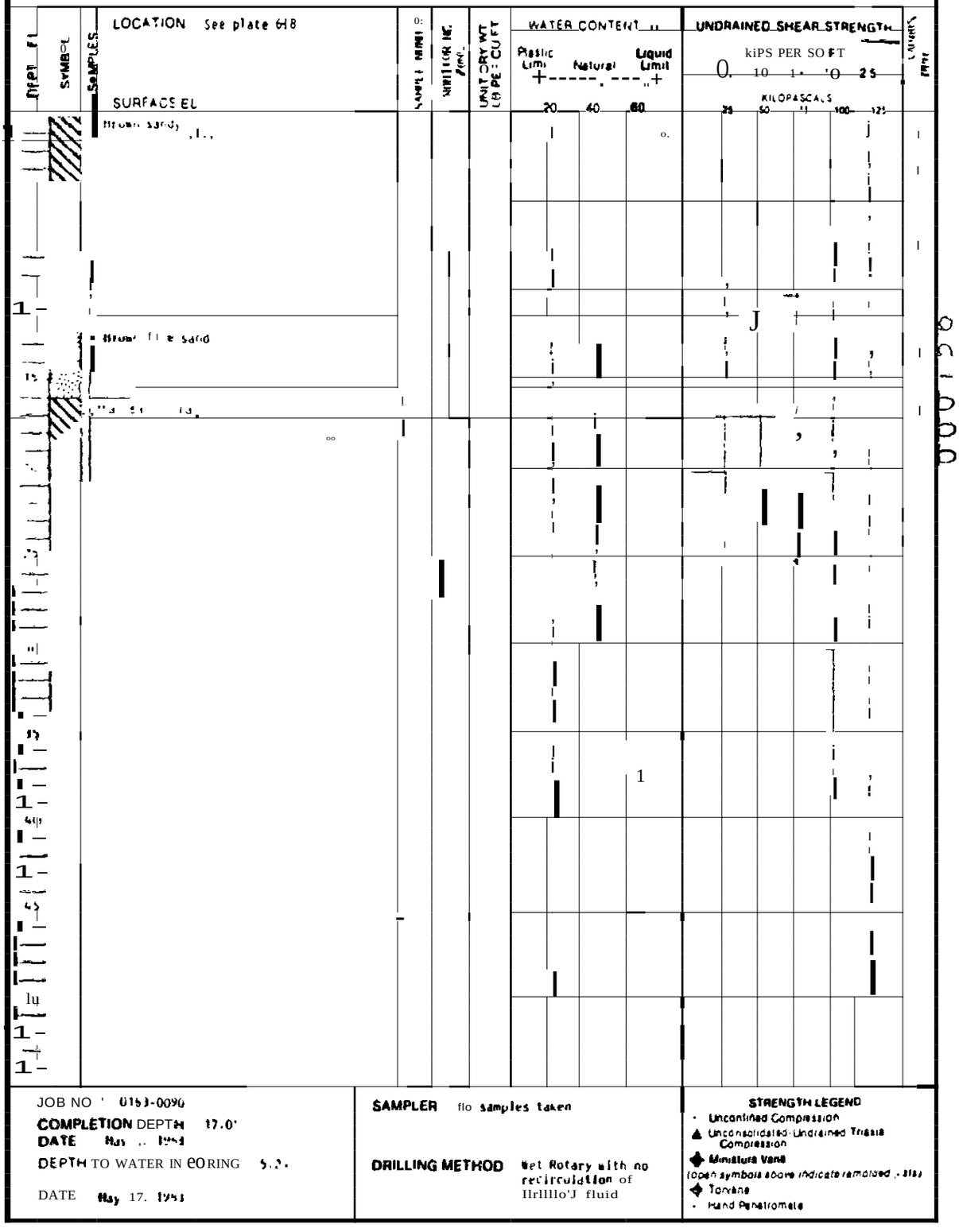
UNDERGROUND RESOURCE MANAGEMENT
CAMP DRESSER & MCKEE

PLATE 6-241

000155

LOG OF BORING NO. CAV-OW·07

CAVALCADE CONTAMINANT SURVEY
METRO-STAGE ONE. AEGIONAL RAIL SYSTEM
HOUSTON. TEXAS



JOB NO ' 0163-0090
COMPLETION DEPTH 17.0'
DATE May .. 1983
DEPTH TO WATER IN BORING 5.2'
DATE May 17. 1983

SAMPLER flo samples taken

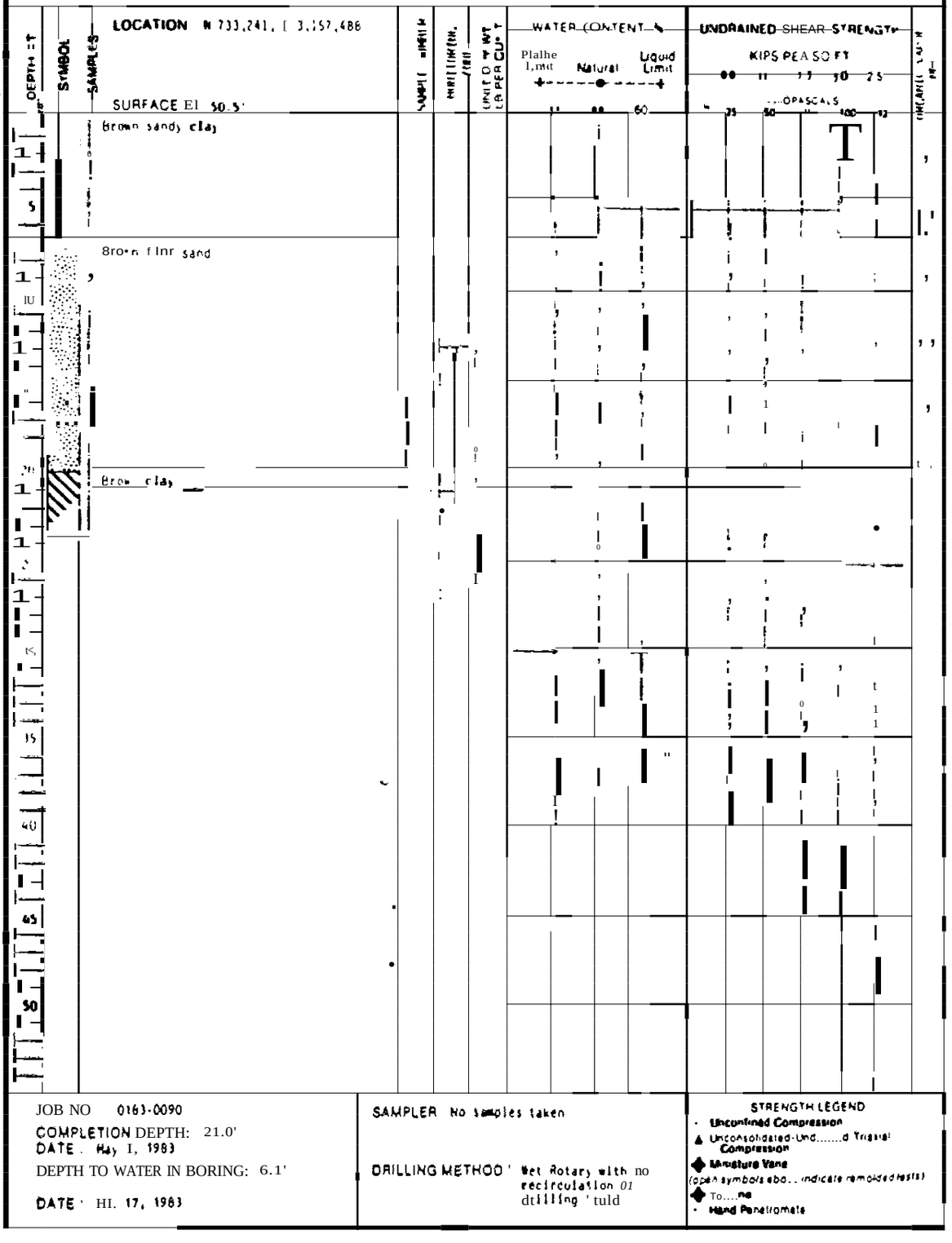
DRILLING METHOD Wet Rotary with no recirculation of Hrllllo'J fluid

STRENGTH LEGEND
- Unconfined Compression
- Unconsolidated-Undrained Triaxial Compression
- Miniature Vane
(open symbols above indicate remolded strength)
- Torvane
- Hand Penetrometer

PLATE6-2f

LOG OF BORING NO. CAV·OW-08

CAVALCADE CONTAMINANT SURVEY
METRO-STAGE ONE. REGIONAL RAIL SYSTEM
HOUSTON, TEXAS



JOB NO 0163-0090
COMPLETION DEPTH: 21.0'
DATE . May I, 1983
DEPTH TO WATER IN BORING: 6.1'
DATE ' HI. 17, 1983

SAMPLER No samples taken

DRILLING METHOD ' Wet Rotary with no recirculation 01 dtilling ' tuld

STRENGTH LEGEND
- Unconfined Compression
- Unconsolidated-Und.....d Triaxial Compression
- Miniature Vane
(open symbols abo... indicate remolded tests)
- To....ne
- Hand Penetrometer

PLATE 6-2

000157

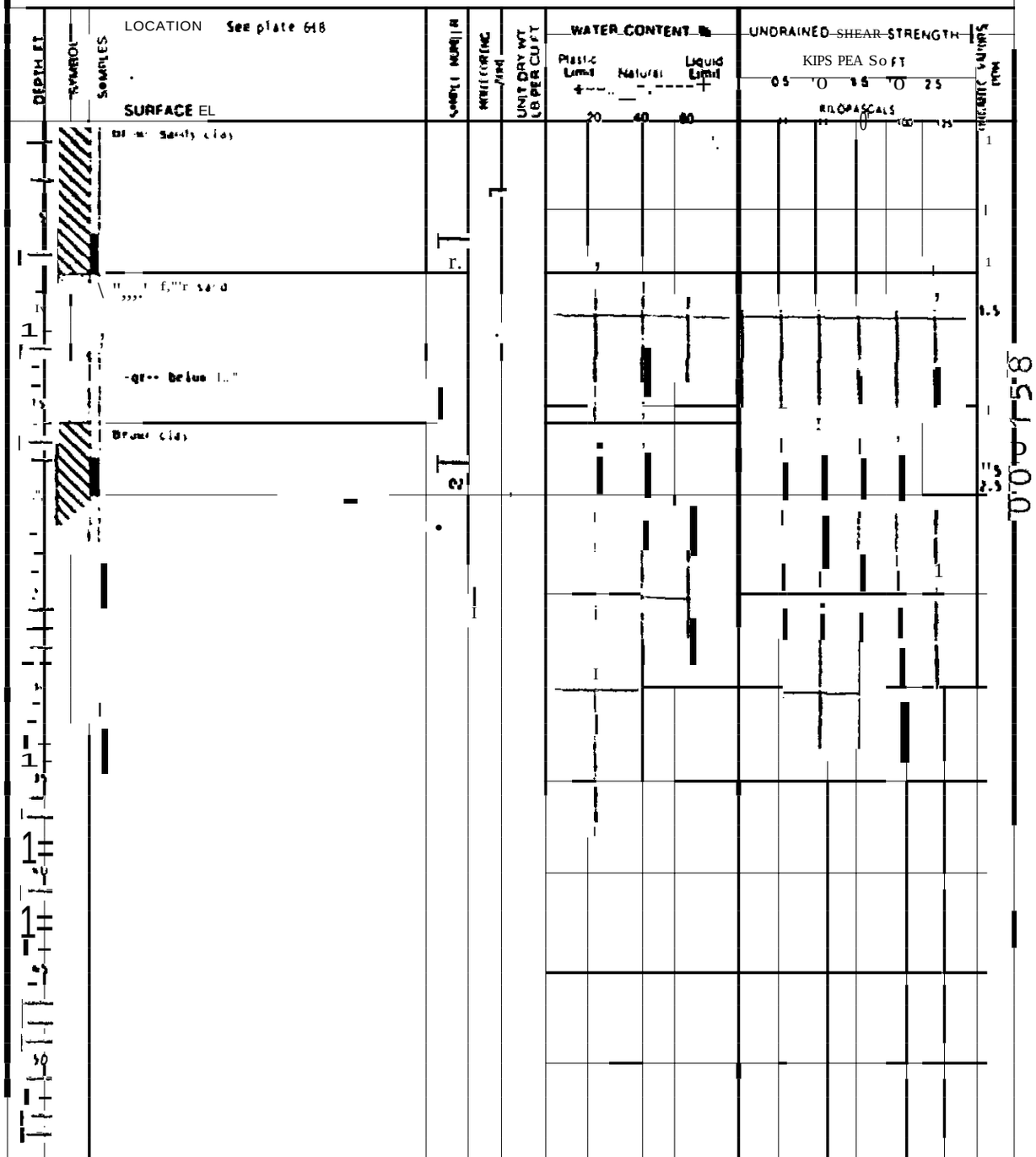
000157

LOG OF BORING NO. CAV-OW-09

CAVALCADE CONTAMINANT SURVey

METRO·STAGE ONE. REGIONAL RAIL SYSTEM

HOUSTON. TEXAS



JOB NO 0151-0090

COMPLETION DEPTH 10.0'

DATE May 5, 1951

DEPTH TO WATER IN BDAING 2.7

DATE May 17, 1981

SAMPLER)- 2Rim-··lled tube

DRILLING METHOD _ Bet Rot.,) *Ith no 'Po lrculation O' drilling fl..id

STRENGTH LEGEND

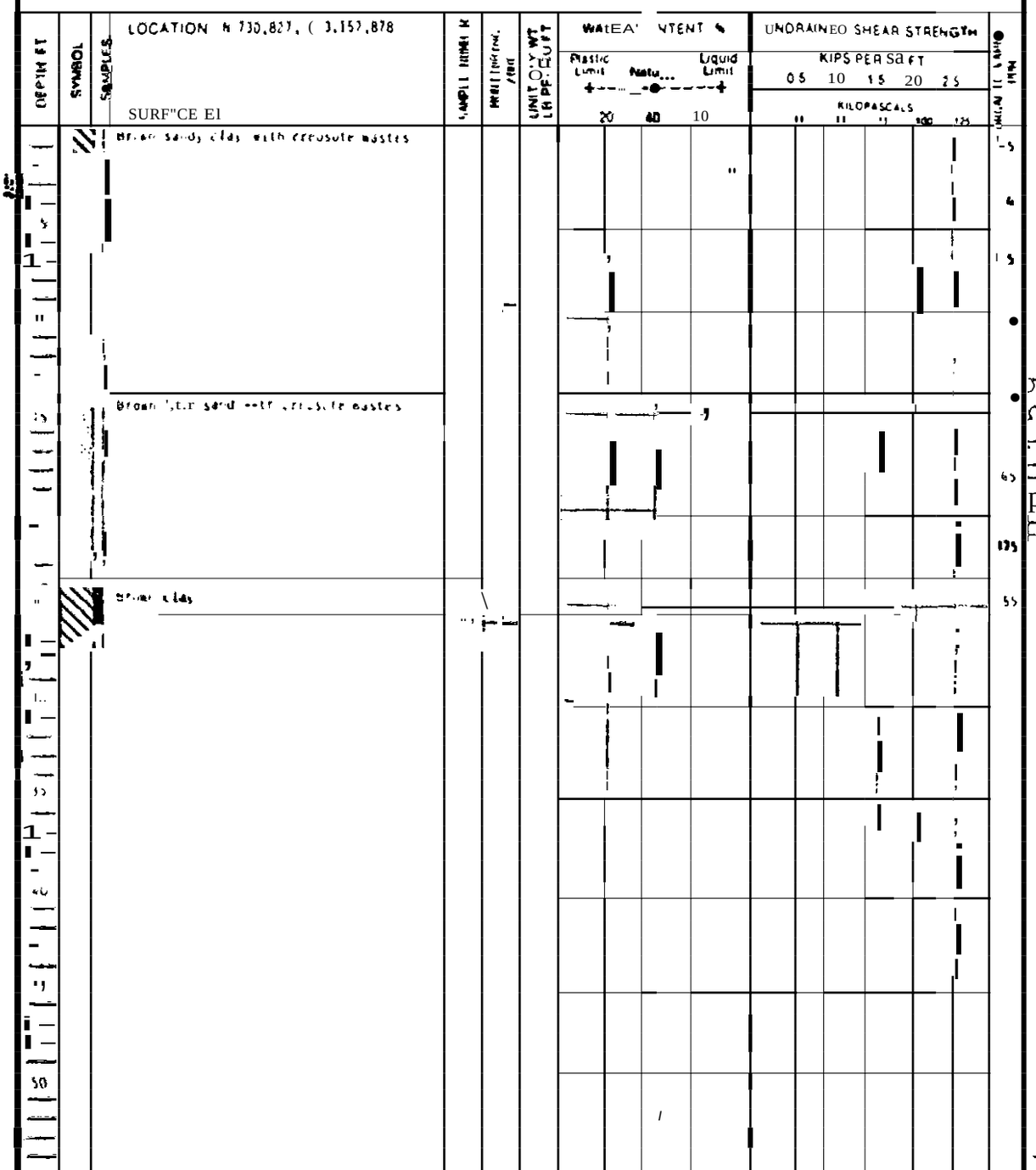
- Unconfined Compression
- Unconsolidated-Undrained Tri..... Compression
- Miniature Vane
- Torsane
- Hand Penetrometer

PLATE 6-27

000158

LOG OF BORING NO. CAV-OW-10

CAVALCADE CONTAMINANT SURVEY
METRO-STAGE ONE, REGIONAL RAIL SYSTEM
HOUSTON. TEXAS



JOB NO 0163-0090
CO"PIETION OEPTH _ 26.0'
DATE May 6, 1963
DEPTH TO WATER IN BORING '.0-
DATE May 17, 1963

SAMPIER 3- thin-walled tube

DRiLING METHOD : Wet rotary with no recirculation O' drilling fluid

STRENGTH LEGEND
- Unconfined Compression
- Unconsolidated-Undrained TO,I'" Compression
- Miniature Vane
(open symbols above indicate remolded tests)
- Torvane
- Hand Penetrometer

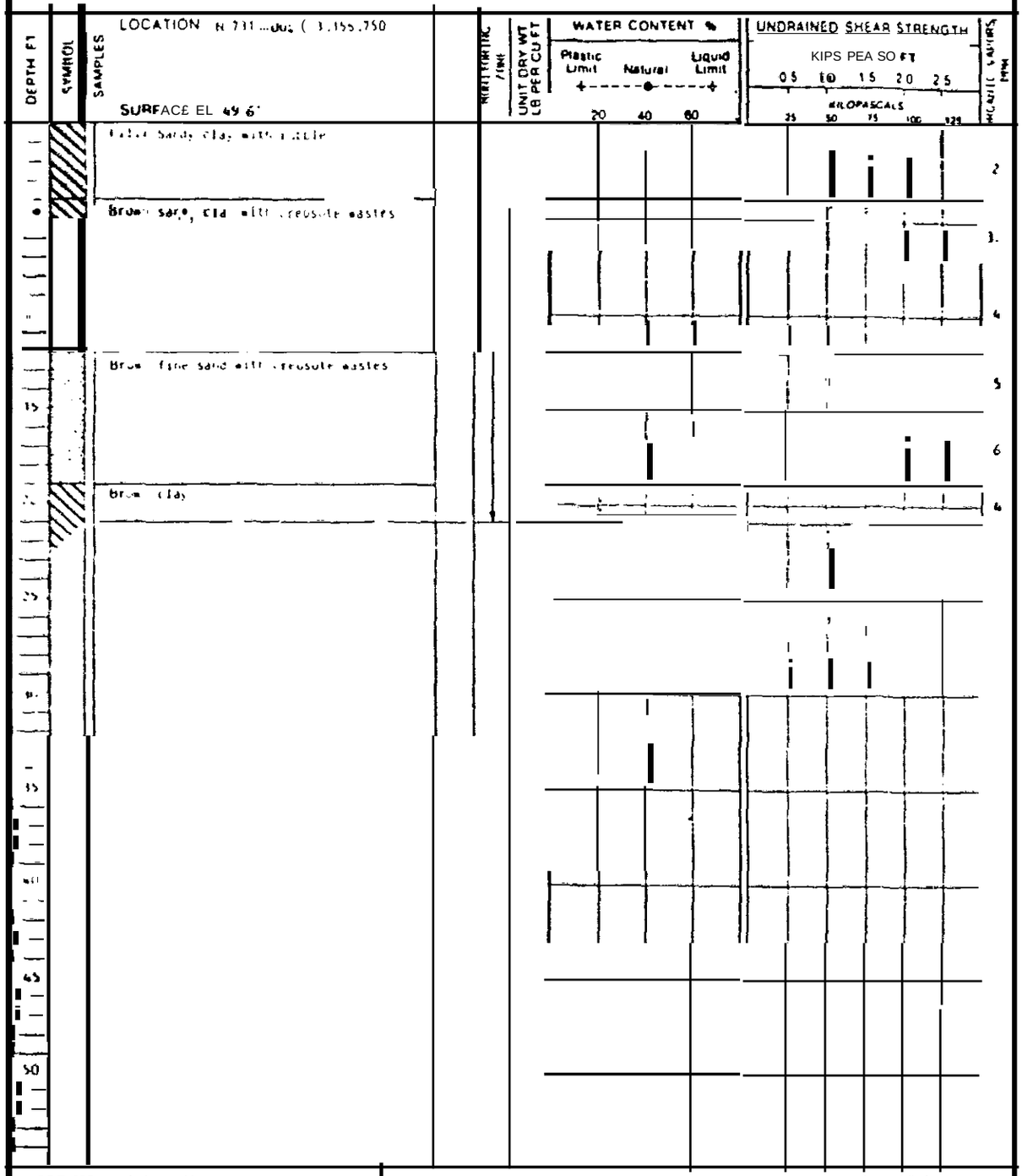
PLATE 6-28

lOG OF BORING NO. CAV-OW-"

CAVALCADE CONTAMINANT SURVEY

METRO-STAGE ONE. REGIONAL RAIL SYSTEM

HOUSTON, TEXAS



JOB NO 0163-0090

COMPLETION OEPTH 21.0'

DATE Hay 5, 1993

DEPTH TO WATER IN BORING 4.0'

DATE . Hay 9, 1993

SAMPLER No samples taken

DRILLING METHOD. Wet Rotary with no recirculation of drilling , lultJ

STRENGTH LEGEND

- Unconfined Compression
- Unconsolidated Undrained Triaxial Compression
- Miniature Vane

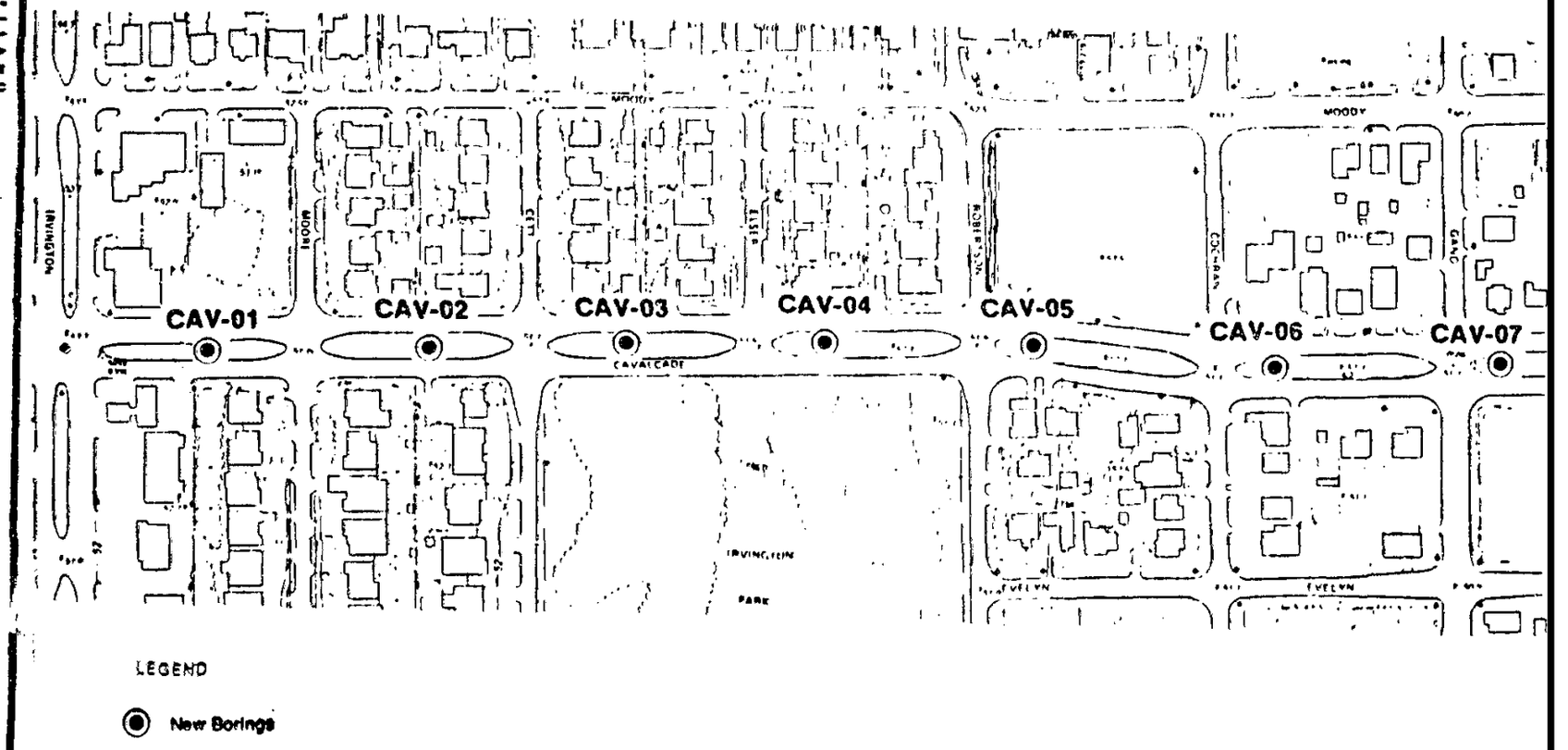
(open symbols above indicate remolded tests)

- Torvane
- Hand Penetrometer

PLATE 6-29

000160

000160



PLAN OF BORINGS
Cavalcade Contaminant Survey

0 100 200 300 Feet

000161

000161

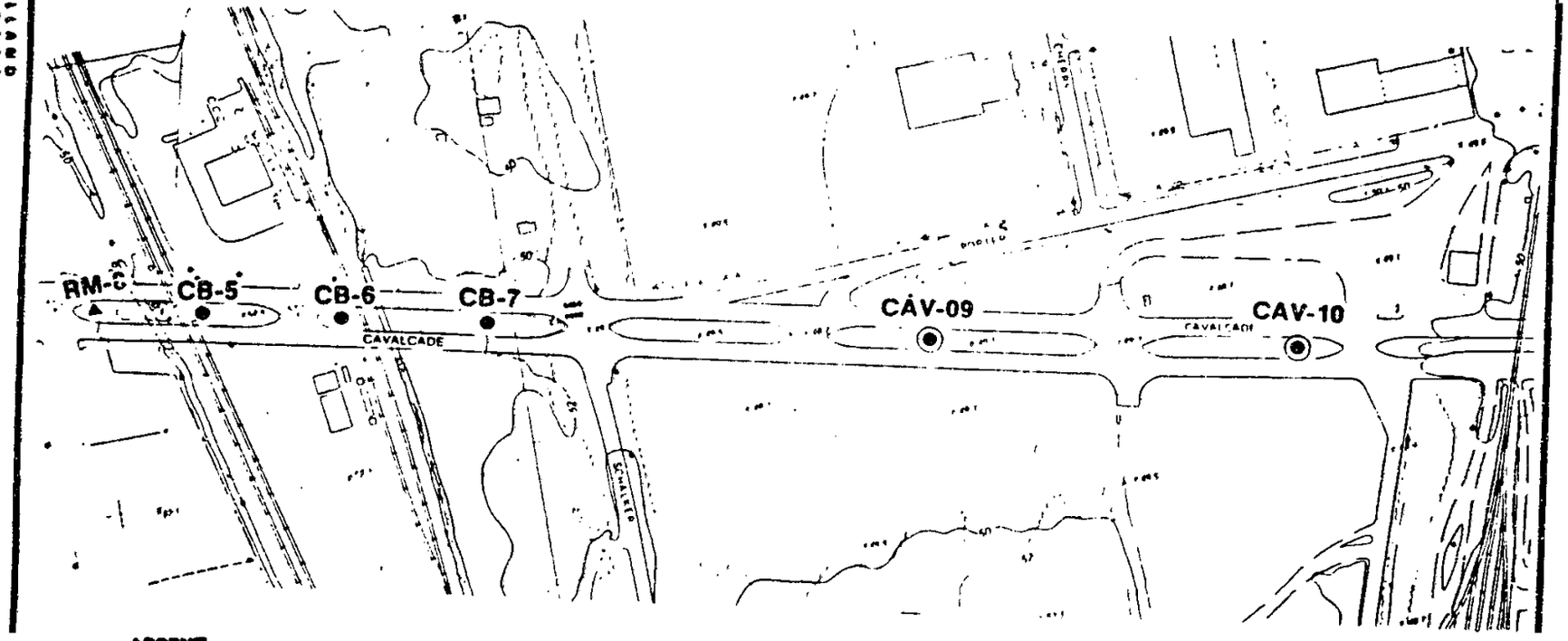
LEGEND

- New Borings
- ▲ Previous McClelland Engineers eo,lng.
- • Previous McBride-Ratcliff eo,lng.

PLAN OF BORINGS

Cavalcade Contaminant *Survey*

o 100 200 300 Foot



LEGEND

- New Borings
- Previous McClelland Engineers Borings
- Previous McBride-Ratcliff Borings

PLAN OF BORINGS

Cavalcade Contaminant *Survey*

0 100 200 300 Feet

PLATE 6-32

000163

000163

LEGEND

New Borings

Previous Texas Department of Highways Borings

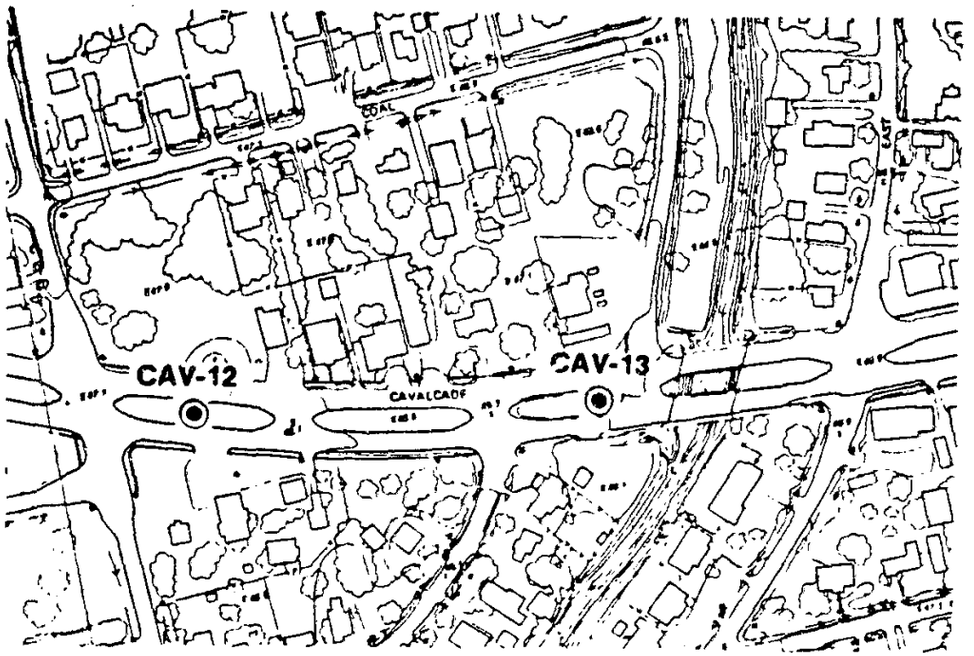
PLAN OF BORINGS
Cavalcade Contaminant Survey

0 100 200 300 Fee

PLATE 6-32d

000164

000164



LEGEND

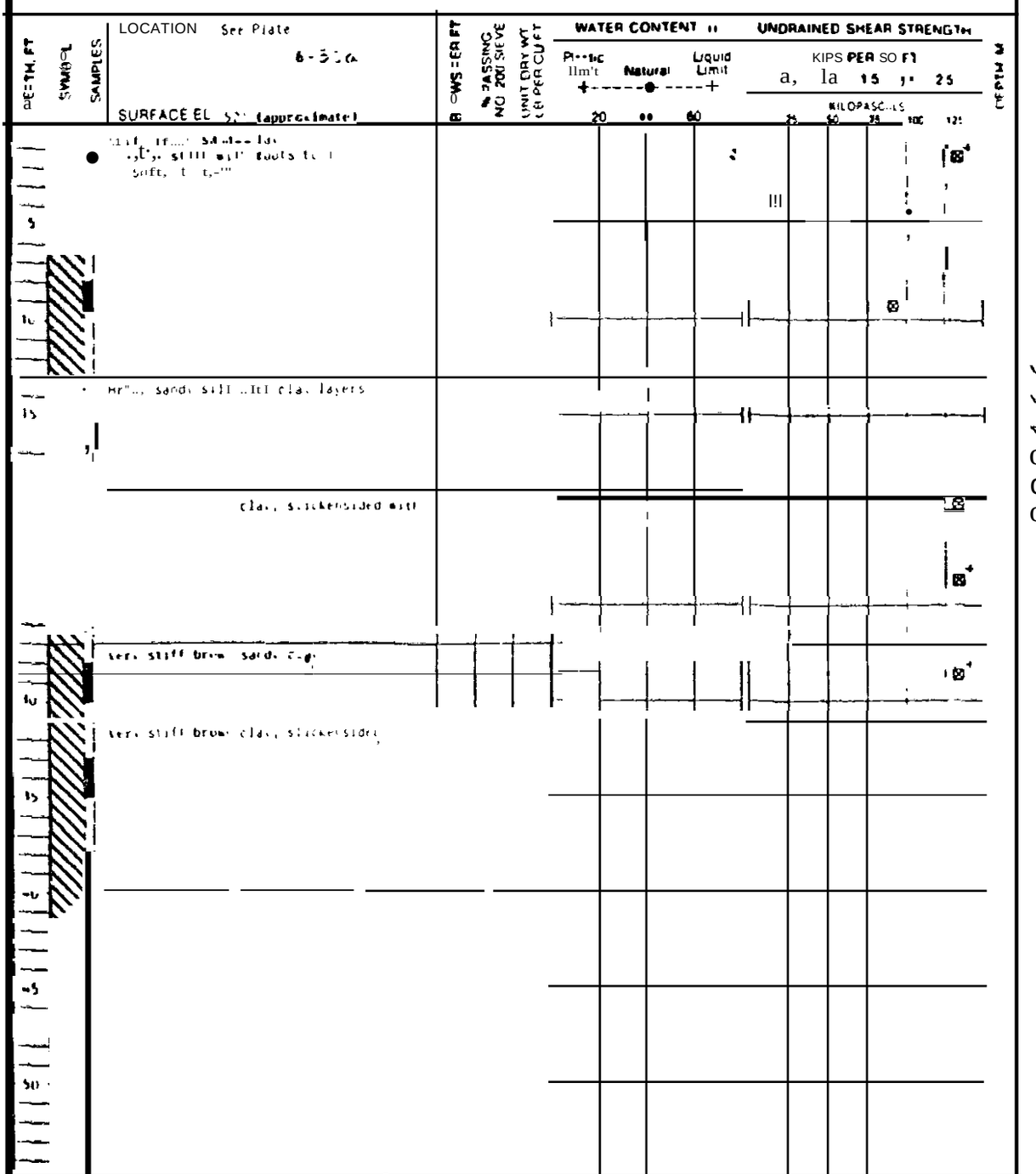
New Borings

PLAN OF BORINGS
Cavalcade Contaminant Survey

0 100 200 300 F**,

lOG OF BORING NO. CAV-01

CAVALCADE CONTAMINANT SURVEY
METRO-STAGE ONE. REGIONAL RAIL SYSTEM
HOUSTON. TEXAS



JOB NO . 0153-(0076
COMPLETION DEPTH 40.0'
DATE March 22, 1983
DEPTH 10 WATER IN BORING: &,6'
CAVED AT 30.6'
DATE April 6, 1983

SAMPLER 3" thin-walled tube

DRILLING METHOD Wet Rotary

STRENGTH LEGEND
- Unconfined Compression
- Unconsolidated-Undrained Triaxial Compression
- Unconfined Vane
(open symbols above indicate remolded)
- Torvane
- Hand Penetrometer

PLATE 6-33

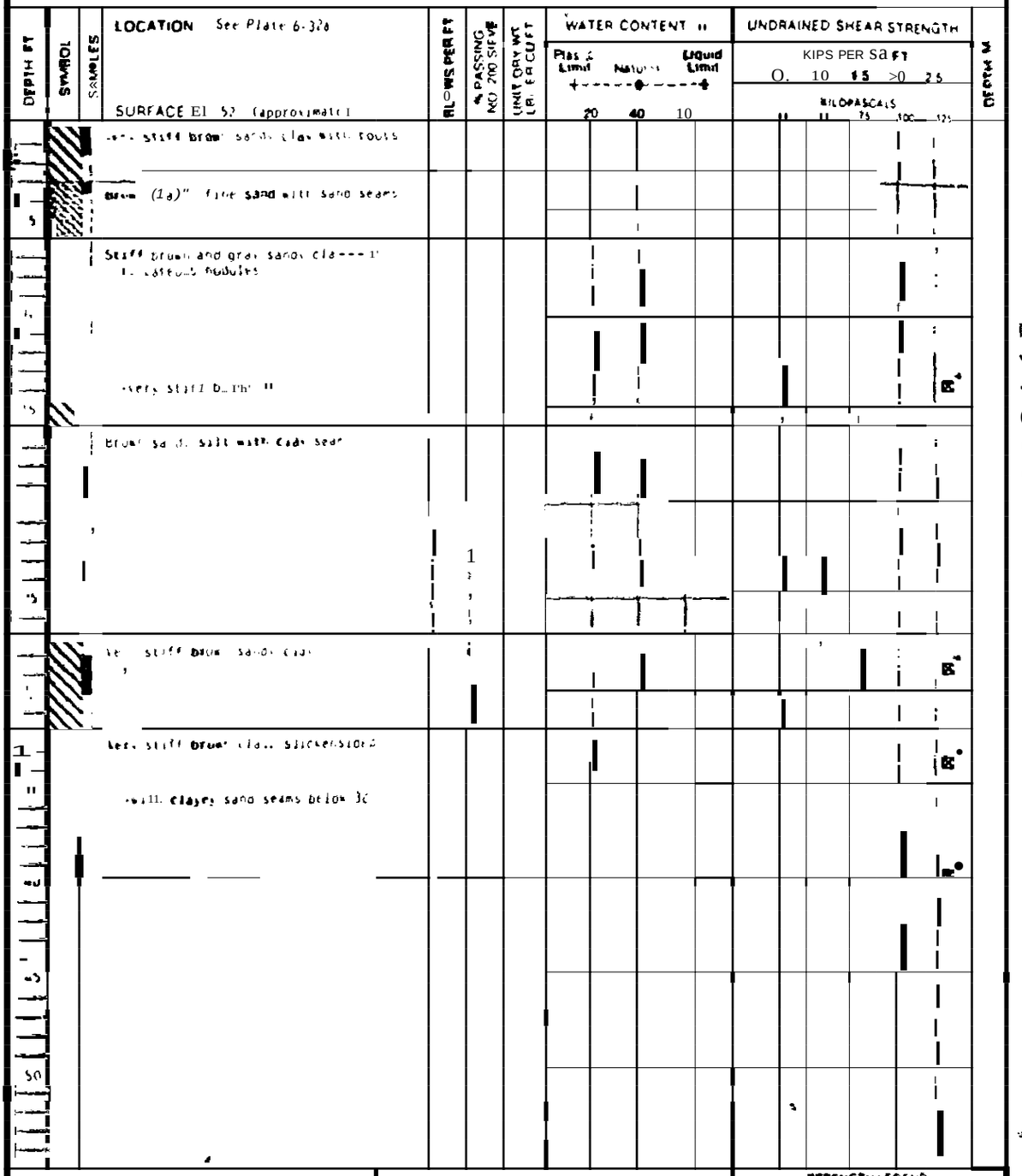
000166

LOG OF BORING NO. CAV-02

CAVALCADE CONTAMINANT SURVEY

METRO-STAGE ONE. REGIONAL RAIL SYSTEM

HOUSTON. TEXAS



JOBNO 0163-0075
COMPLETION DEPTH 40.0'
DATE March 22, 1983
DEPTH TO WATER IN BORING 5.0'
CAVED AT 17.2'
DATE April 6, 1983

SAMPLER 3" thin-walled tube

DRILLING METHOD Wet Rotary

STRENGTH LEGEND
- Unconfined Comp.....or
- Unconsolidated-Undrained Triaxial Compression
- Miniature Vane

(open symbols above indicate remolded tests)
- Torvane
- Hand Penetrometer

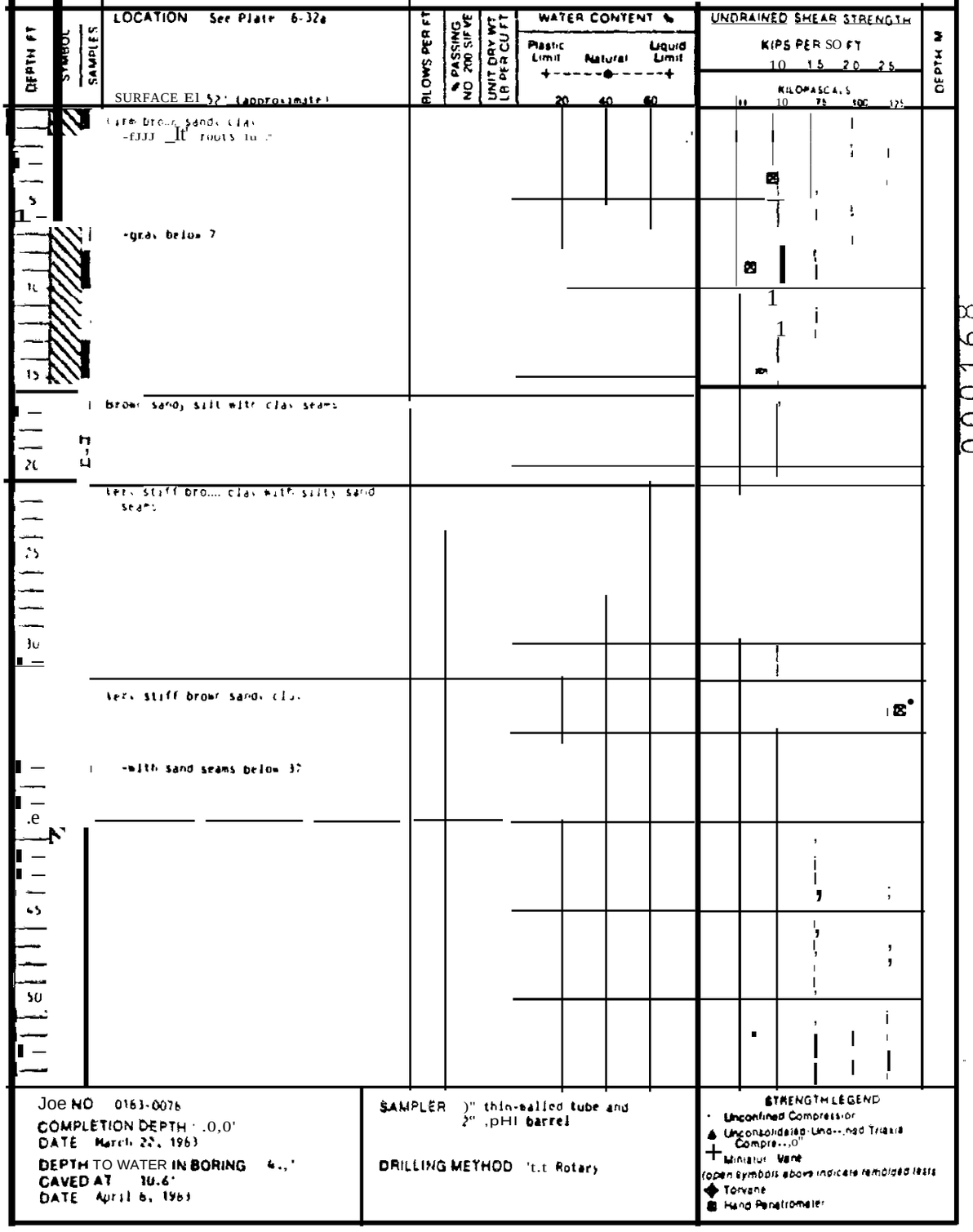
PLATE 6-34

000167

000167

LOG OF BORING NO. CAY-03

CAVALCADE CONTAMINANT SURVEY
METRO-STAGE ONE. REGIONAL RAIL SYSTEM
HOUSTON. **TEXAS**



Job NO 0163-0076
COMPLETION DEPTH 50.0'
DATE March 22, 1963
DEPTH TO WATER IN BORING 4.5'
CAVED AT 10.6'
DATE April 6, 1963

SAMPLER 3" thin-walled tube and 2" split barrel

DRILLING METHOD Wet Rotary

STRENGTH LEGEND
- Unconfined Compression
- Unconsolidated-Undrained Triaxial Compression
- Miniature Vane

(open symbols above indicate remolded tests)
- Torvane
- Hand Penetrometer

PLATE 6-35

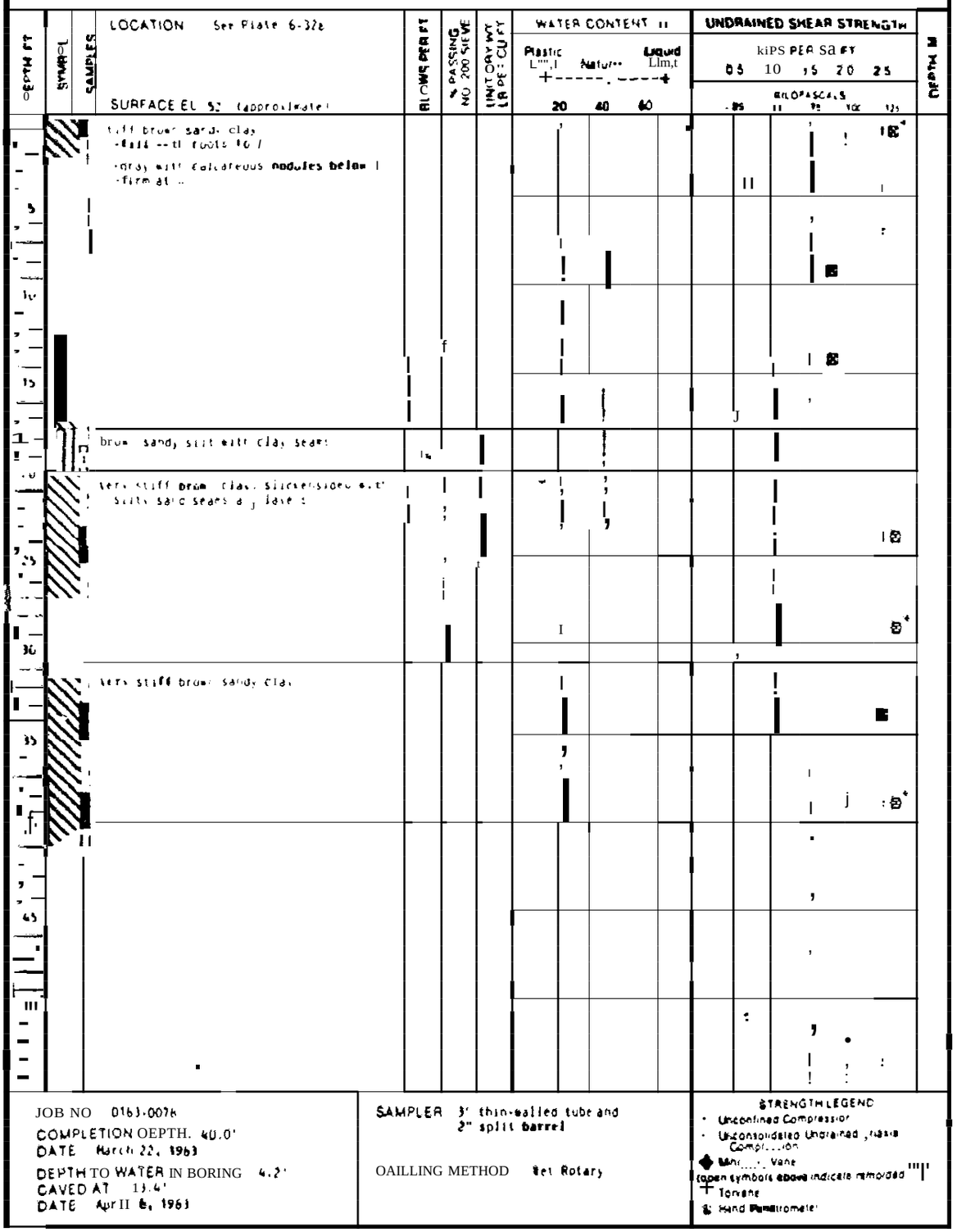
000168

LOG OF BORING NO. CAV-04

CAVALCADE **CONTAMINANT** SURVEY

METRO-STAGE ONE. REGIONAL RAIL **SYSTEM**

HOUSTON. TEXAS



JOB NO 0163-007A
COMPLETION OEPTH. 40.0'
DATE March 22, 1963
DEPTH TO WATER IN BORING 4.2'
CAVED AT 13.4'
DATE April 6, 1963

SAMPLER 3" thin-walled tube and 2" split barrel

OAILLING METHOD Wet Rotary

STRENGTH LEGEND
- Unconfined Compression
- Unconsolidated Undrained Triaxial Compression
- Miniature Vane
(open symbols above indicate remolded)
- Torvane
- Hand Penetrometer

PLATE6-3t

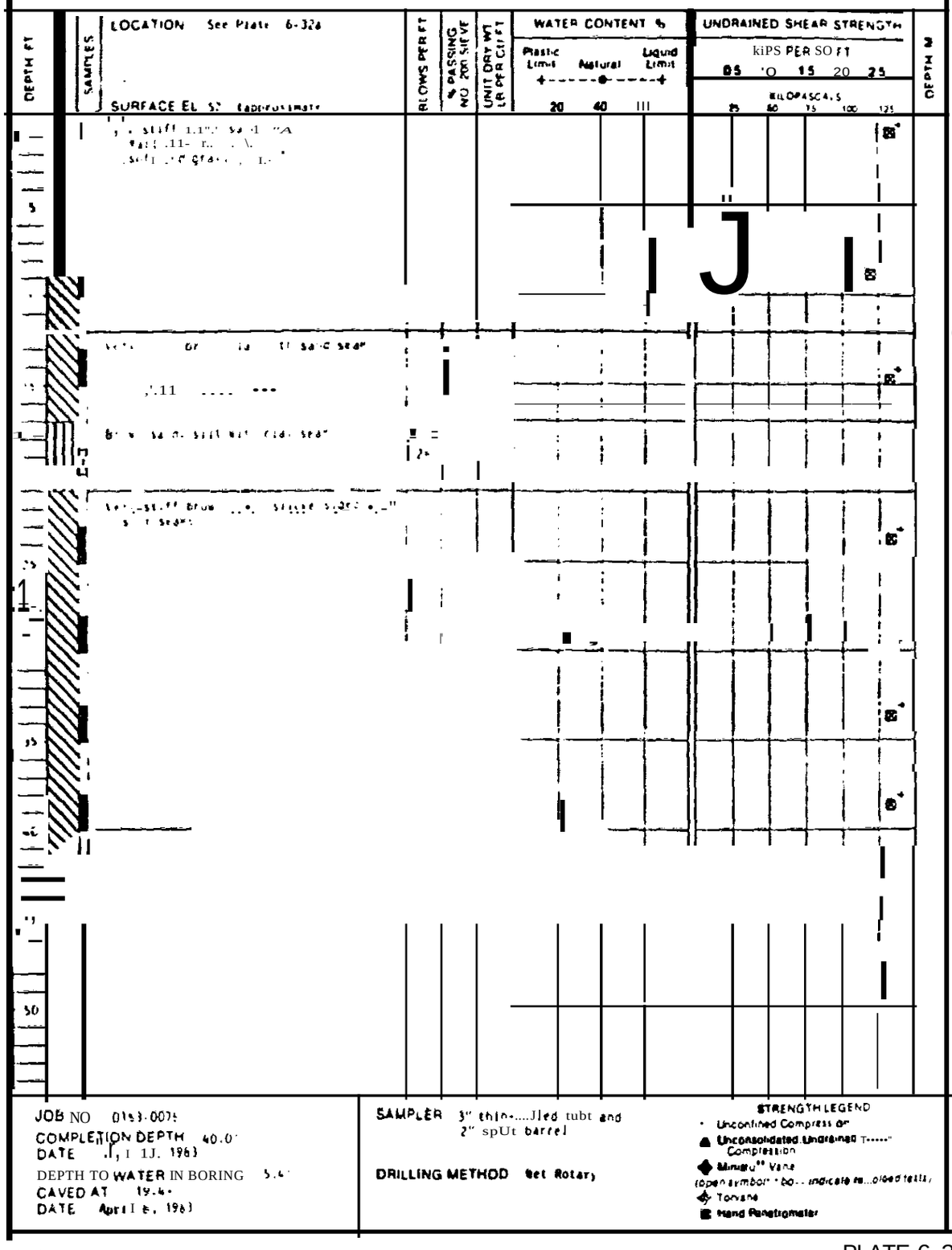
000169

LOG OF BORING NO. CAY-OS

CAVALCADE CONTAMINANT SURVEY

METRO-STAGE ONE. REGIONAL RAIL **SYSTEM**

HOUSTON. TEXAS



JOB NO 0193-0075
COMPLETION DEPTH 40.0'
DATE .I, I 1J. 1983
DEPTH TO WATER IN BORING 5.4'
CAVED AT 19.4'
DATE April 6, 1983

SAMPLER 3" thin-....Jled tubt and 2" spUt barrel

DRILLING METHOD Wet Rotary

STRENGTH LEGEND
- Unconfined Compress or
- Unconsolidated Undrained T------" Compression
- Minatu** Vane
(open symbol* bo... indicate re...oload tests)
- Torvane
- Hand Penetrometer

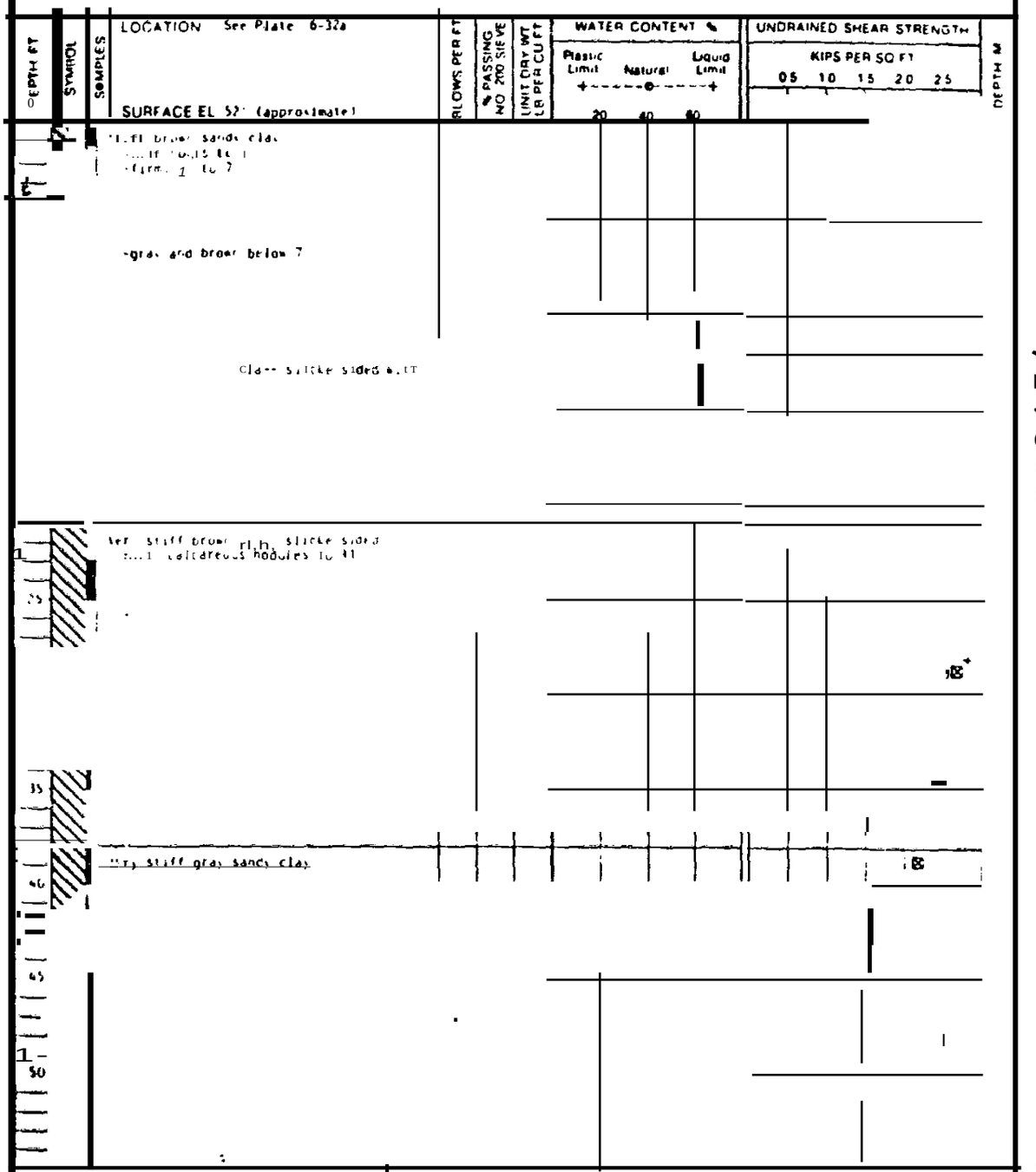
PLATE 6-37

LOG OF BORING NO. CAV-06

CAVALCADE CONTAMINANT SURVEY

METRO-STAGE ONE. REGIONAL RAIL **SYSTEM**

HOUSTON. TEXAS



JOB NO 0163-0076

COMPLETION OEPTH' 40.0'

DATE March 23, 1963

DEPTH TO WATER IN BORING 1.1'

CAVED AT

DATE April 6. 1963

SAMPLER 3" thin-walled tube and 2" split barrel

DRILLING METHOD Wet Rotary

STRENGTH LEGEND

- Unconfined Compression
- Unconsolidated Undrained Triaxial Compression
- Miniature Vane

(Open symbols above indicate remolded tests)

- Torvane
- Hand Penetrometer

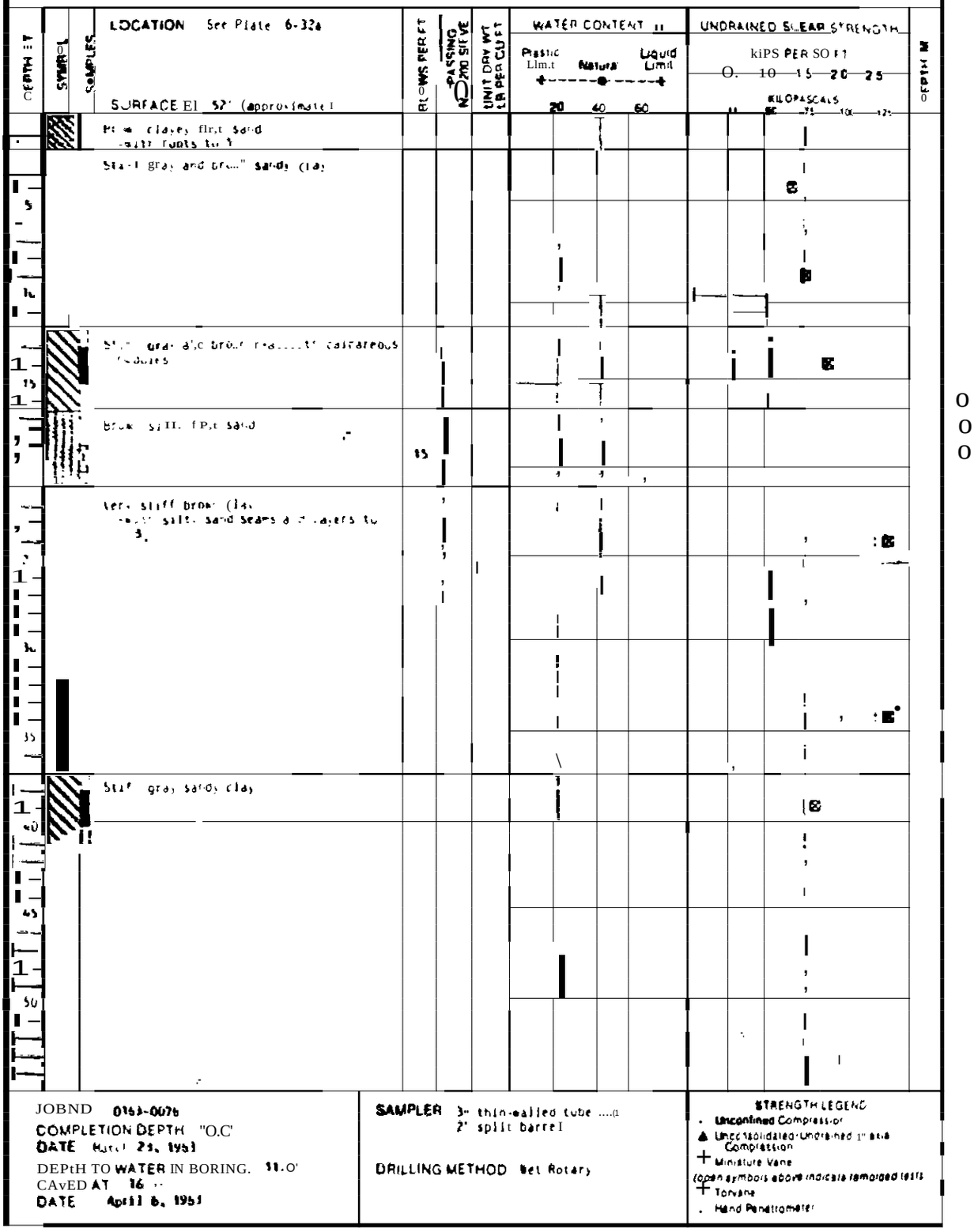
PLATE 6-38

000171

000171

LOG OF BORING NO. CAV-07

CAVALCADE CONTAMINANT SURVEY
METRO-STAGE ONE. REGIONAL RAIL SYSTEM
HOUSTON. TEXAS



JOBND 0153-0076
COMPLETION DEPTH "O.C'
DATE March 24, 1953
DEPTH TO WATER IN BORING. 11.0'
CAVED AT 16 '
DATE April 6, 1953

SAMPLER 3" thin-walled tube
2" split barrel

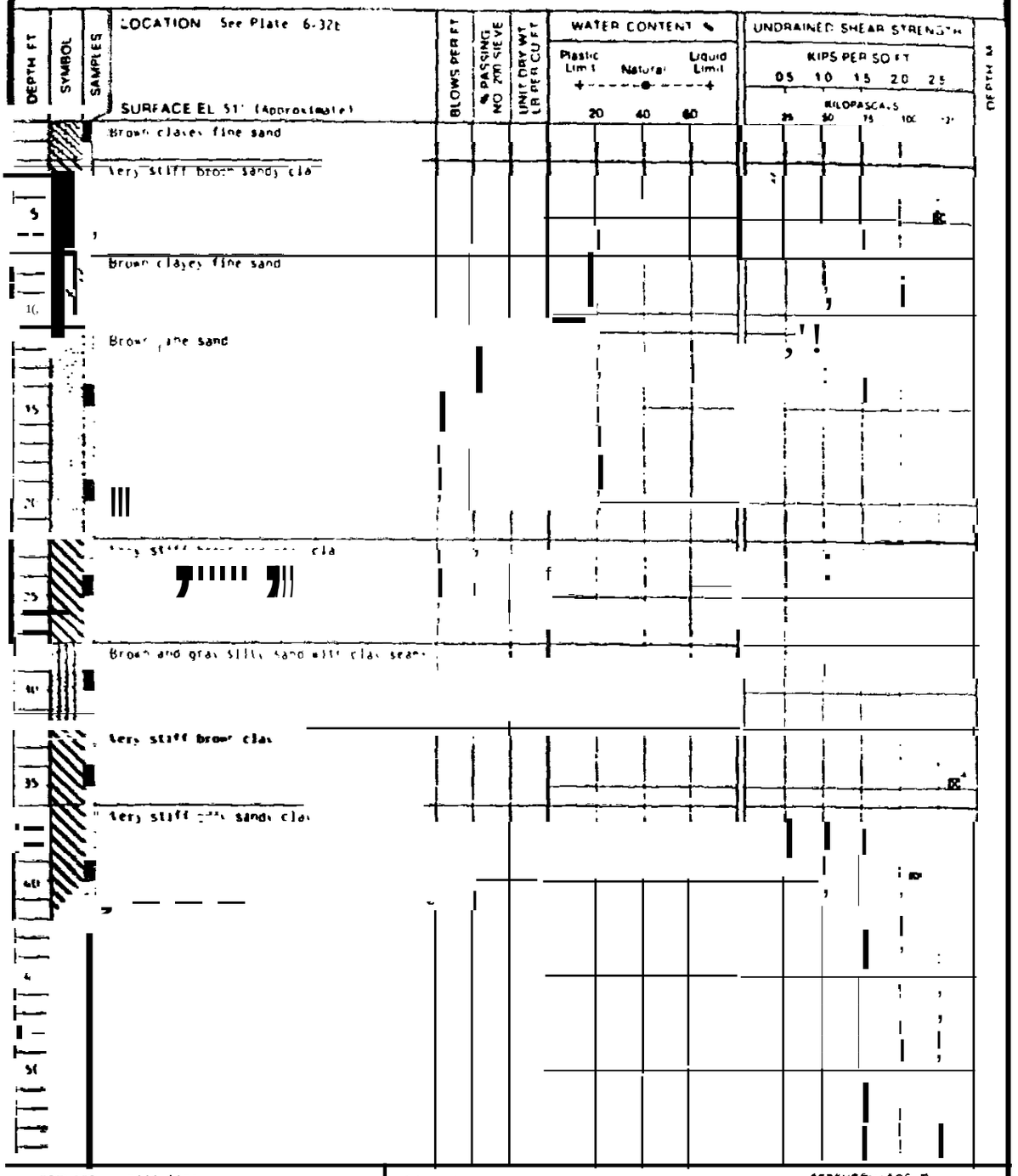
DRILLING METHOD Wet Rotary

STRENGTH LEGEND
- Unconfined Compression
- Unconsolidated-Undrained Triaxial Compression
+ Miniature Vane
(Open symbols above indicate remolded tests)
+ Torvane
- Hand Penetrometer

PLATE 6-39

000172

LOG OF BORING C-V-CAV-08
CAVALCADE CONTAMINANT SURVEY
METRO-STAGE ONE, REGIONAL RAIL SYSTEM
HOUSTON, **TEXAS**



JOB NO 0163-0090
COMPLETION DEPTH - 110.0'
DATE May 31, 1963
DEPTH TO WATER IN BOLLING, 7."
CAVED liT, 9.6'
DATE May 31, 1963

SAMPLER 3.. thin-walled tube

DRILLING METHOD : Wet Rotary

STRENGTH LEGEND
- Unconfined Compression
- Unconsolidated-Undrained Triaxial Compression
- + Menist..... Vane
(Open symbols above indicate remolded tests)
- Td.....
- Hand Penetrometer

McCLELLAND

PLATE 6-4Q

000173

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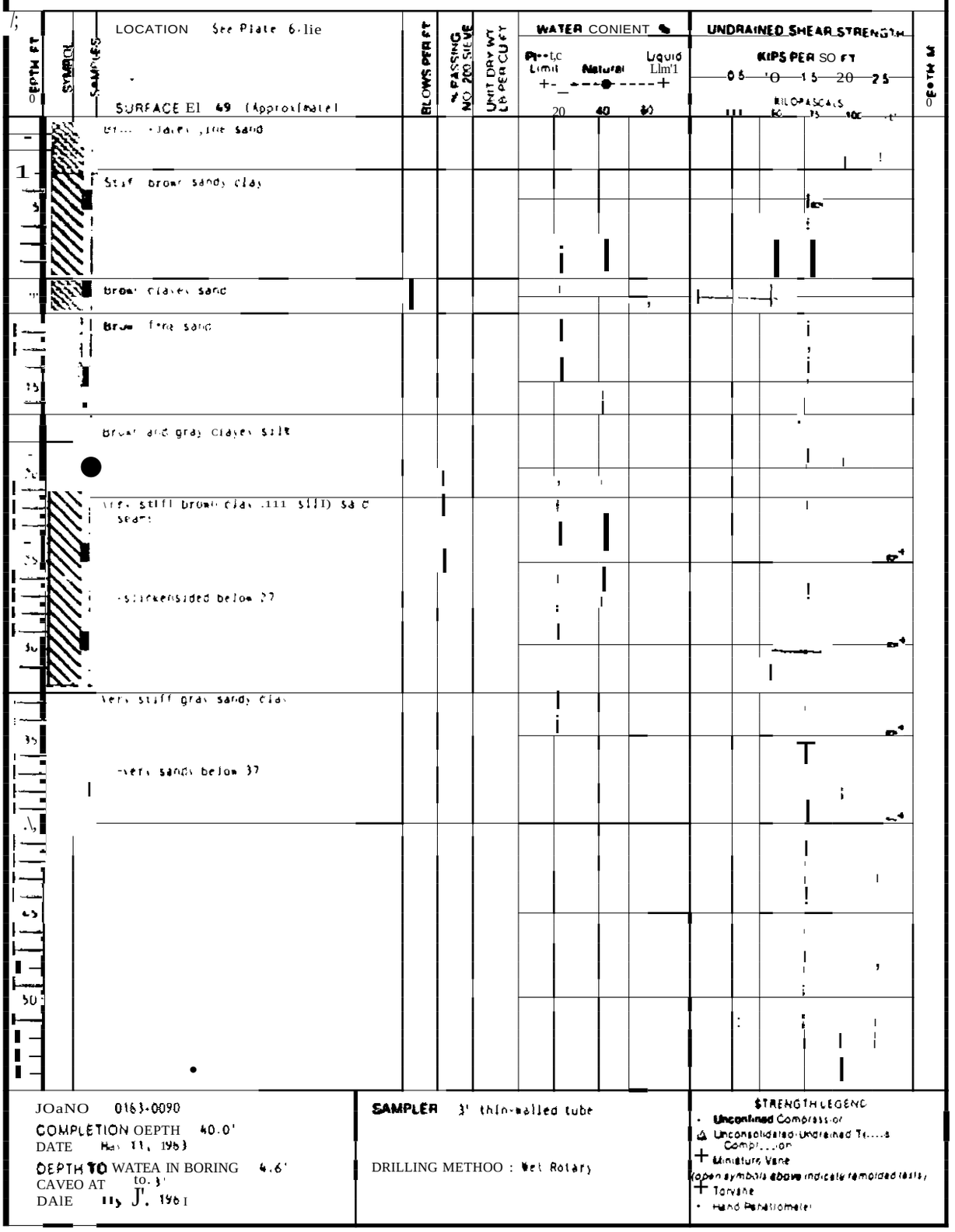
LOG OF BORING NO. CAV·09

CAVALCADE CONTAMINANT SURVEY

METRO-STAGE ONE. REGIONAL RAIL SYSTEM

HOUSTor**J**, TEXAS



JOaNO 0163-0090

COMPLETION OEPTH 40.0'

DATE May 11, 1963

OEPTH TO WATEA IN BORING 4.6'

CAVEO AT to. 3'

DAIE May 1, 1961

SAMPLER 3' thin-walled tube

DRILLING METHOO : Wet Rotary

STRENGTH LEGEND

- Unconfined Compressior
- Unconsolidated-Undrained Tr.....s Compr....on
- + Miniature Vane

(open symbols above indicate remolded tests)

- + Torvane
- Hand Penetrometer

PLATE 6-41

000174

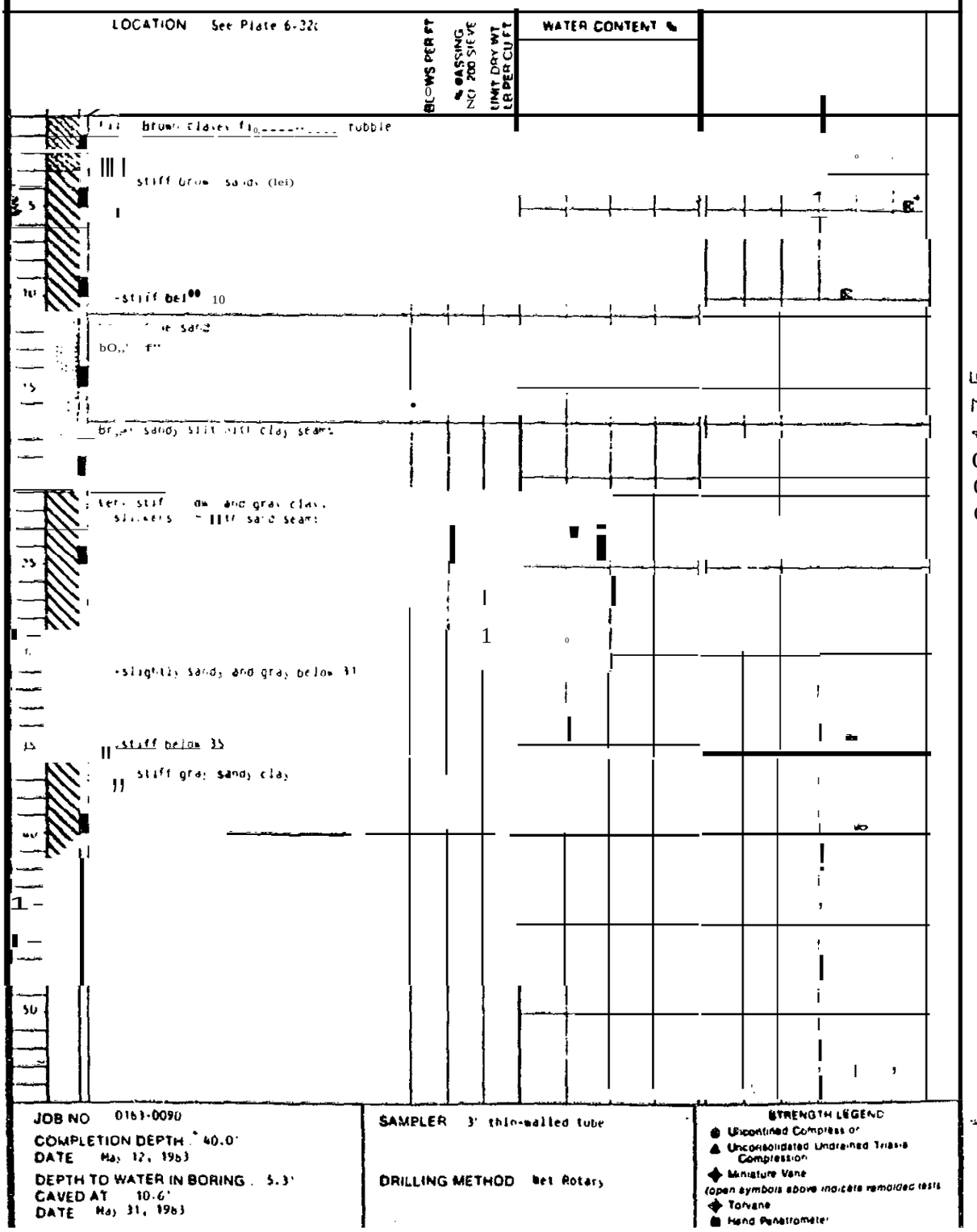
000174

LOG OF BORING NO. CAV-10

• CAVALCADE CONTAMINANT SURVEY

METRO-STAGE ONE, REGIONAL RAIL SYSTEM

HOUSTON, TEXAS



JOB NO 0163-0090
COMPLETION DEPTH 40.0'
DATE May 12, 1983
DEPTH TO WATER IN BORING 5.3'
CAVED AT 10.6'
DATE May 31, 1983

SAMPLER 3" thin-walled tube

DRILLING METHOD Wet Rotary

STRENGTH LEGEND
- Unconfined Compressi or
- Unconsolidated Undrained Triaxial Compression
- Miniature Vane
- (open symbols above indicate remolded tests
- Torvane
- Hand Penetrometer

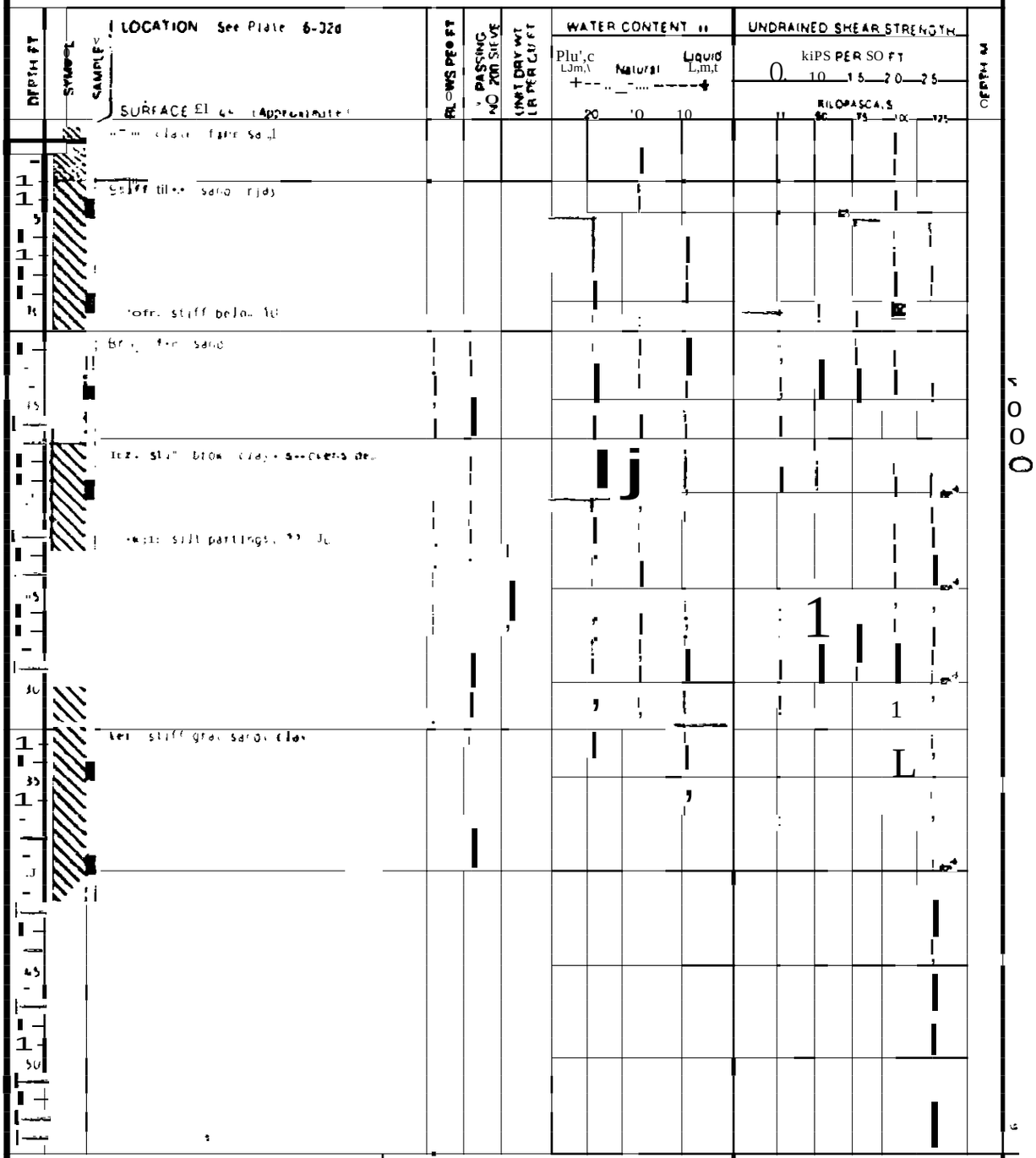
PLATE 6-42

000175

000175

LOG OF BORING NO. CAV·11

CAVALCADE CONTAMINANT SURVEY
METRO-STAGE ONE. REGIONAL RAIL SYSTEM
HOUSTON. TEXAS



Joe NO 0163-0090
COMPLETION DEPTH 60.0'
DATE H'J 11. 19bJ
DEPTH TO WATER IN eORING 6.8'
CAVED AT 11.3'
'DATE Ma) II, 19A1

SAMPLER 3.. thin-walled tube

DRiILING **METHOD** . Bet Rotary

STRENGTH LEGEND
- Unconfined Compression
- Unconsolidated-Undrained Triaxial Compression
- Miniature VII"
- Torvane
- Hand Penetrometer

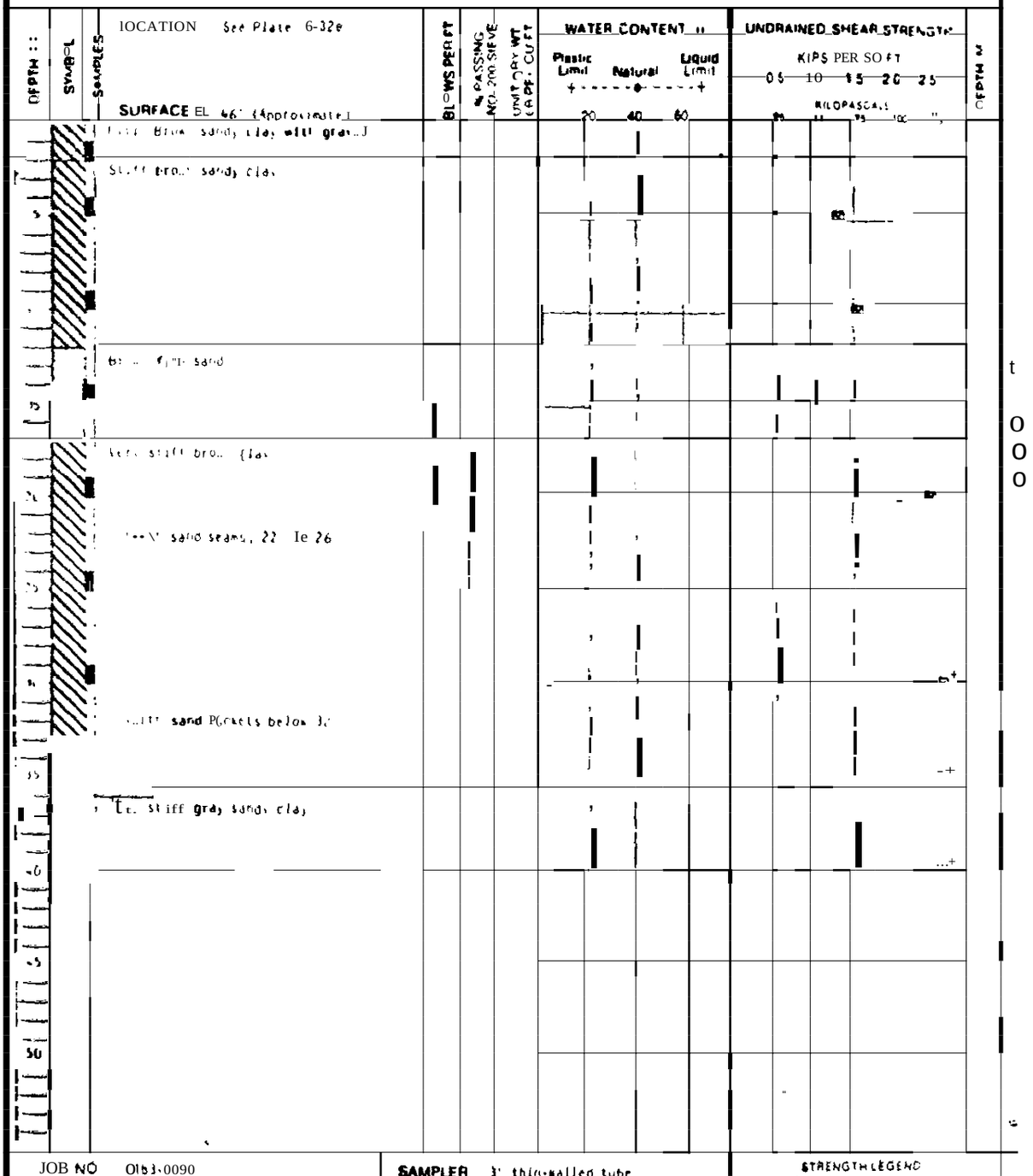
PLATE 6-43

LOG OF BORING NO, CAV·12

CAVALCADE CONTAMINANT SURVEY

METRO-STAGE ONE. REGIONAL RAIL SYSTEM

HOUSTON, TEXAS



JOB NO 0183-0090

COMPLETION DEPTH 40.0'

DATE May 11, 1983

DEPTH TO WATER IN BORING Hole obstructed

CAVED AT

DATE May , 1983

SAMPLER 3" thin-walled tube

DRILLING METHOD Wet Rotary

STRENGTH LEGEND

- Unconfined Compression
- Unconsolidated Undrained Texas Compression
- Miniature Vane

(Open symbols above indicate remolded tests)

- Torvane
- Hand Penetrometer

WOODWARD-CLYDE CONSULTANTS

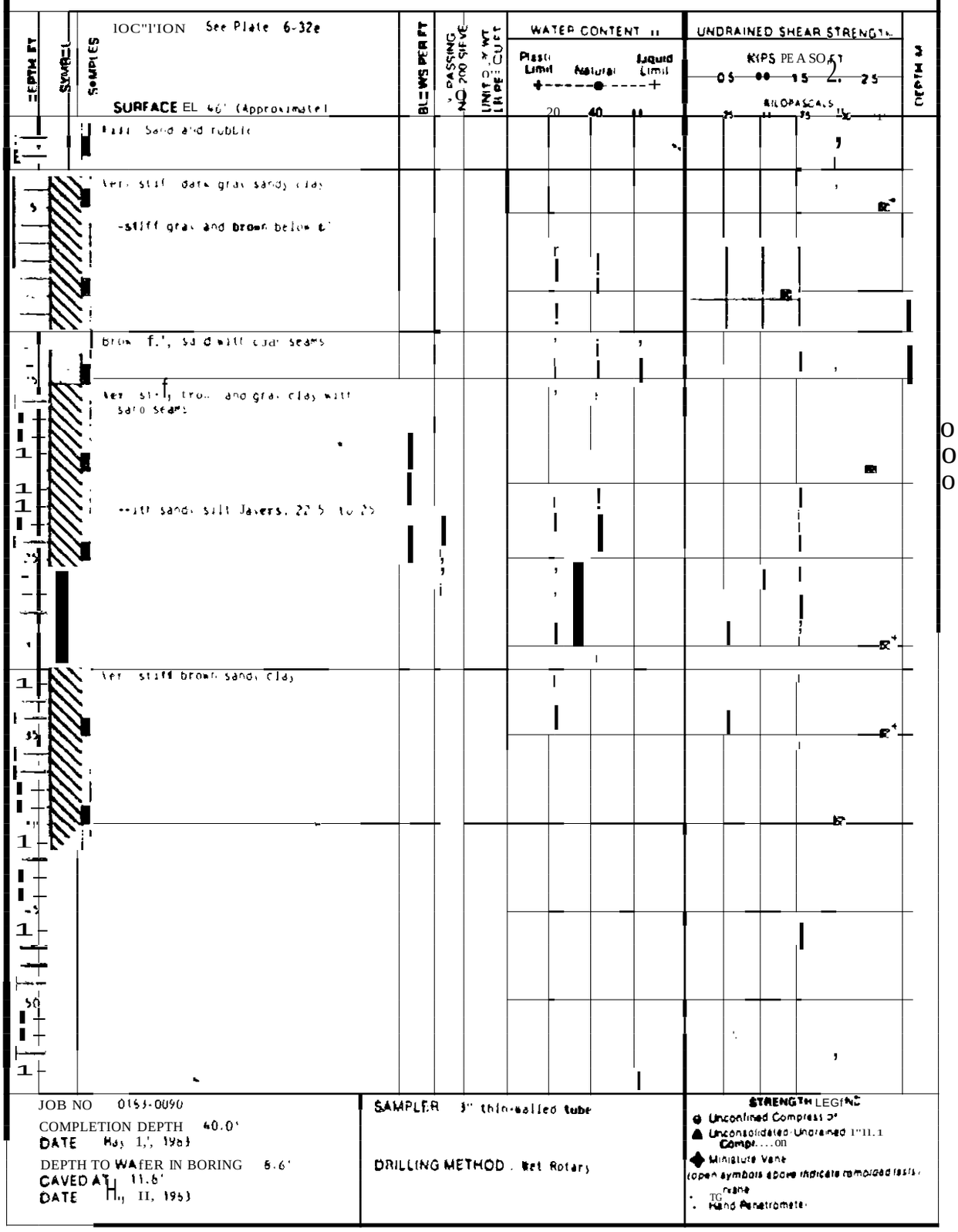
PLATE 6-44

lOG OF BORING NO. CAV.13

CAVALCAOE CONTAMINANT SURVEY

METRO-STAGE ONE. REGIONAL RAIL SYSTEM

HOUSTON. TEXAS



JOB NO 0163-0090

COMPLETION DEPTH 40.0'

DATE May 1,', 1963

DEPTH TO WATER IN BORING 5.6'

CAVED AT 11.6'

DATE May 11, 1963

SAMPLER 3" thin-walled tube

DRILLING METHOD . Wet Rotary

STRENGTH LEGEND

- Unconfined Compress.
- Unconsolidated-Undrained Triaxial Compression
- Miniature Vane

(open symbols above indicate remolded tests)

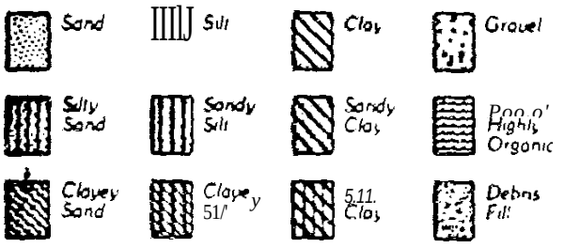
- TG Crane
- Hand Penetrometer

PLATE 6-45

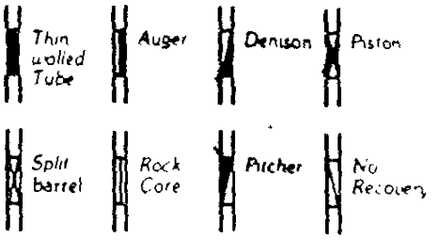
000178

TERMS AND SYMBOLS USED ON BORING LOGS

SOIL TYPES

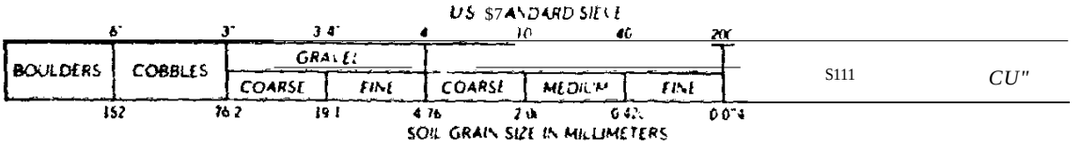


SAMPLER TYPES



SOIL GRAIN SIZE

US STANDARD SIEVE



SOIL GRAIN SIZE IN MILLIMETERS

STRENGTH OF COHESIVE SOILS [1]

Consistency	Undrained Shear Strength Kips Per Sq Ft.
Very Soft	less than 0.25
Soft	0.25 to 0.50
Firm	0.50 to 1.00
Stiff	1.00 to 2.00
Very Stiff	2.00 to 4.00
Hard	greater than 4.00

CONSTANT or GRANULAR SOILS [2,3]

Descriptive Term	*Relative Density, %
Very Loose	less than 15
Loose	15 to 35
Medium Dense	35 to 65
Dense	65 to 85
Very Dense	greater than 85

*Estimated from sampler driving record

SPLIT-BARREL SAMPLER DRIVING RECORD

Blows Per FOOT	Description
25	25 blows drove sampler 12 inches, after initial 6 inches of seating
50/7	50 blows drove sampler 7 inches after initial 6 inches of seating
R.I 3".	50 blows drove sample 3 inches during initial 6 inch seating interval

Note: To avoid damage to sampling tools, driving is limited to 50 blows during or after seating interval

SOIL STRUCTURE [1]

Slickensided ... Having planes of weakness that appear slick and glossy. The degree of slickensidedness depends upon the spacing of slickensides and the ease of breaking along these planes

Fissured ... Containing shrinkage or relief cracks, often filled with fine sand or silt, usually more or less vertical

Pocket ... Inclusion of material of different texture that is smaller than the diameter of the sample

Parting ... Inclusion less than 1/8 inch thick extending through the sample

Seam ... Inclusion 1/8 inch to 3 inches thick extending through the sample

Layer ... Inclusion greater than 3 inches thick extending through the sample

Laminated ... Soil sample composed of alternating partings or seams of different soil type

Interlayered ... Soil sample composed of alternating layers of different soil type

Intermixed ... Soil sample composed of pockets of different soil type and layered or laminated structure is not evident

Calcareous ... Having appreciable quantities of carbonate

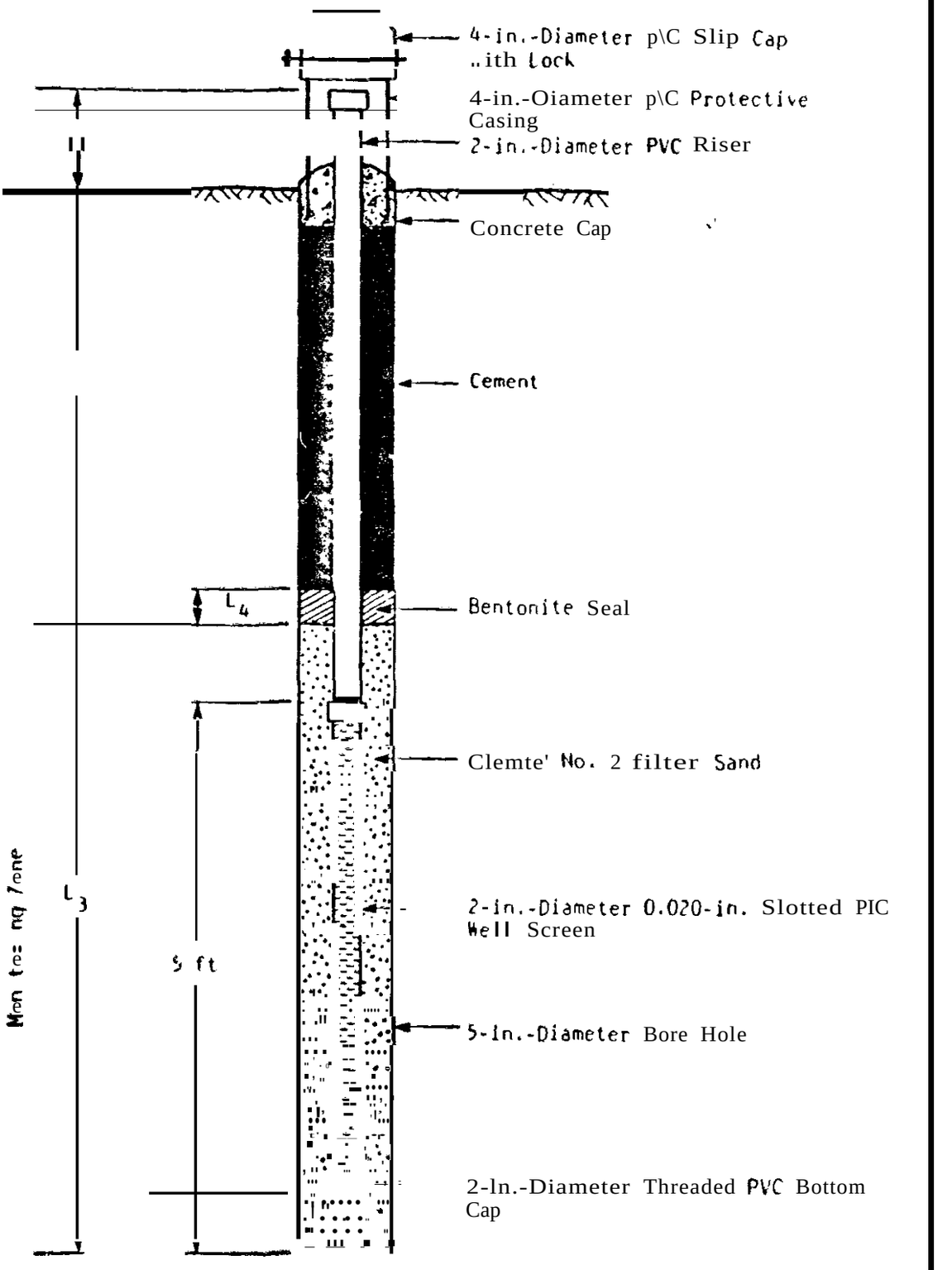
REFERENCES:

(1) ASTM D 2488
(2) ASCE Manual 56 (1976)
(3) ASTM D 2049

Information on each boring log is a compilation of subsurface conditions based on soil or rock classifications obtained from the field as well as from laboratory testing of samples which have been interpreted by commonly accepted procedures. The stratum lines on the logs may be transitional and approximate in nature. Water level measurements refer only to those observed at the times and places indicated, and may vary with time, geologic condition or construction activity.

PLATE 6.4

000179



TYPICAL MONITORING WELL CONSTRUCTION

Well No.	location Coordinates North	East	Ground Surface Elevation	Dimensions (Feet) L_1	L_2	L_3	L_4	L_5	Instdlldtion Date	Sand Stratum Top	Bottom
CAV-OW-01	732152	3158563	50.4	2.0	13.8	5.7	2.2	0.4	2-7-83	11.5	18.5
CAV-OW-02	733695	3157796	51.3	2.2	10.5	9.5	1.4	0.0	2-5-83	10.0	19.0
CAV-OW-03	734599	3157963	49.1	2.5	11.5	7.5	1.7	0.1	2-7-83	11.5	18.5
CAV-OW-04	734773	3157676	51.1	2.2	10.3	9.2	2.1	0.0	2-6-83	11.5	19.5
CAV-OW-05	735883	3157557	51.0	2.0	7.5	6.7	1.8	0.1	2-7-83	0.5	13.0
CAV-OW-07				2.0	7.4	9.6	0.6	0.9	5-3-83	11.0	16.0
CAV-OW-08	733241	3157488	50.5	1.il	12.8	8.2	1.8	2.0	5-3-83	7.0	20.0
CAV-OW-09				2.0	3.3	16.7	1.4	5.0	5-17-83	12.0	16.0
CAY-OW-10	730827	3157878		2.0	9.1	16.7	0.5	3.0	5-17-83	16.0	14.n
CAV-OW-11	731400	3158750	49.6	2.0	7.1	13.9	1.6	2.0	5-9-83	11.0	19.0
CAV-OW-13	733216	3158329		2.0	7.9	12.6	1.5	2.0	5-17-83	9.5	20.0
CAV-OW-14	733720	3158200	50.2	2.0	9.7	10.8	0.n	1.5	5-17-83	11.0	17.0

MONITORING WEll INSTALLATION DATA

Well Number	Groundwater Elevations (Ft)					
	2-8-83	5-9-83	5-17-83	5-26-83	6-2-83	6-24-83
CAV-OW-01	49.9		49.6			49.5
CAV-OW-02	49.4		46.1		46.9	46.9
CAV-OW-03	47.5		47.3	48.0	47.0	46.9
CAV-OW-04	46.6		46.2	47.4	46.6	46.6
CAV-OW-05	47.1		46.1			46.5
CAV-OW-07		45.6	46.1	46.8	46.6	46.4
CAV-OW-08		43.9	44.6	45.5	49.2	44.7
CAV-OW-09		44.2	46.6	47.9		
CIIV-OW-10		41.5	43.7	43.8	42.8	
CAV-OW-11		45.8				
CAV-OW-13		46.6	49.0	49.4	48.7	
CAV-OW-14		46.1	47.7	49.3	47.7	48.5

PLATE 6-49

SUMMARY OF GROUNDWATER ELEVATIONS

000182

CDM
environmental engineers, scientists
planners & management consultants

CAMP DRESSER & McKEE INC

3445 Executive Center Drive, Suite 220
Austin Texas 78731
512 345 6651 Cable CAMWAT

April 29, 1983

Texas Department of Water Resources
Enforcement and Field Operations Division
P. O. Box *13087,* Capitol Station
Austin, Texas 78711

Attention: Mr. Michael Dick

Dear Mr. Oick:

This letter is written to confirm our discussions of 12 April 1983 with regard to installation of a deep monitor well at the Cavalcade property, currently being considered by the Houston Metropolitan Transit Authority for a rail and maintenance yard. The intent of this letter is to describe the details of the well construction and to piovide you with some additional informatlon which was not available at the time of our meeting.

As you are aware, the proposed well is being installed to obtain information with regard to potential subsurface contamination and the qualit.l' of ground water beneath the Cavalcade property_ The well will be drilled dpproximately 200 feet southeast of Site N, one of the sites sampled during the preliminary investigation of the property carried. out by COM and McClelland Engineerlng. and the location where deepest penetration of creosote contamination was found. The specific objectives in constructing the deep well are:

Ij to sample soil encountered during drilling operations.

2) to collect samples of ground water in the "target aquifer".

3) to establish the piezometric head in the "target aquifer".

The "target aQuife," appears to be a relatively continuous sand which occurs .t about 200 feet below the ground surface and, according to available drillers logs, ranges in thickness from approximately 10 to 80 feet. This aquifer is the Shallowest subsurface sand known to be yielding or capable of yielding water to local wells in the vicinity. Actual termination of the well could be as shallow as 150 to.180 feet below the land surface, if the sand is encountered at those depths or as deep as 300 feet; however, if no sand is encountered before reaching 250 feet below the land surface, the deep monitor well program will be abandoned and the hole will be plugged with a nonshrink cement grout.

The drilling and install.tion of the well will proceed as follows (see attached illustration).

1) All equipment, including drill rods, bits, mud tank. drill $tem, and well casings will be steam cleaned or flushed, as appropriate.

2) Once an .cceptable location has been found, a six (6) inch open rotary hole will be drilled to "clean" clay strata as detennined in

000183

000183

the field by the supervising geologist or engineer. based on visual examination of drill hole material for creosote products and/or use of an HNU photoionizer. Maximum depth of the six inch hole will be 150 feet.

3) The drilling fluid used to advance the six inch boring will a bentonite-only based fluid with no other additives. The density of the drilling fluid will be maintained at a minimum of 120% of the density of water, a density greater than the density of creosote or coal tars.

4) At least once after passing through the surficial sand (upper 20 feet) and between 20 feet and 150 feet. the drilling fluid will be discarded. all equipment cleaned as described above. and fresh fluid prepared for further ,.drilling.

5) Soil samples will be collected every ten (10) to twenty (20) feet using either Shelby tube samplers or split-spoon samplers from the ground surface to the bottom of the hole ("200-foot" sand). The last sample collected will be from the clay or silt underlying the "200. foot" sand. A representative specimen from each sample *recovered* will be retained by the supervising geologist or engineer. Samplers will be steam cleaned or cleaned wito wa'_ . methanol between uses.

6) Once clean clay strata have been encountered. assumed to be at a depth of between 50 to 150 feet below the ground surface, the hole will be reamed to eight (8) inches and a six inch casing will be set and seated into clay or silty clay at the bottom of the hole. If the six inch casing is to be left in the hole, it will be cemented in place.

7) Drilling beyond ISO feet or the termination of the six inch casing will employ potable water or a light mud mixture. pumped through only once and not reCirculated to the hole.

8) A ten (10) foot long. four .(4) inch diameter wire-wrapped screen with four inch diameter riser will be installed to the bottom of the "200· foot" sand. A wash down plug will be used in case of hole collapse. A sand pack or filter cloth will be used if necessary.

9) Using a tremie pipe. the four inch riser will be grouted, with a nonshrink cement bentonite mlX. back to the ground surface from a cement basket placed above the screen. The six inch casing 10111 be removed from the hole during the grouting process as appropriate.

10) The well will be covered with a suitable locked protector.

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PLATE 6-50

The procedures above have been formulated based on anticipated subsurface conditions. The procedures will be modified as necessary in response to actual conditions encountered during drilling as *deemed* appropriate.

Two of the soil specimens retained by the supervising geologist or engineer will be sent to a laboratory for a complete Priority Pollutant scan. One of these specimens will be from the sample obtained from just below the six inch surface casing (apprOXimately ISO feet). The other specimen will possibly be from just below the screened sand. Final determination of which soil samples are to be analyzed will be made on completion of drilling and will be reviewed with TOWR.

It is anticipated that all water associated with drilling, development and sampling of the well can be disposed of in the sanitary sewer system; tentative approval has already been received. Alternatively, all water will be disposed of by spreading on-site; some discharge to existing site drainage can be anticipated. All solids and drilling mud recovered during advancement of the boring will be *removed* from the site and disposed of at an appropriate solid waste facility.

All necessary precautions will be taken during installation of the well to reduce the possibility that surface contamination will be transported downward in the hole and to insure, to the extent possible, that samples obtained are representative of actual conditions. It is to be emphasized that construction of the well will be accomplished according to strict protocols and in a *conservative* manner.

If you have any questions regarding the procedure outlined above for installation of the monitor well at Cavalcade, please contact me as soon as possible. Approval of this letter by you or the designated representative of TOWR will constitute acceptance of the well construction and installation procedure and will allow us to proceed with its implementation.

Sincerely yours,

CAMP DRESSER & McKEE INC.

Robert S. K1er

ACCEPTED:

TEXAS DEPARTMENT OF WATER RESOURCES

BY: _____

T1TLE: _____

DATE: _____

0 0 0 5 8

PLATE 6-50

Sample Number	Coordinates North	Coordinates East	Ground Surface Elevation	Top of Casing Elevation
CAL-SW-01	732,020	3,156,186	46.2	
CAL-SW-02	711,669	3,156,690		
CAL-SD-01	732,020	3,156,176	46.2	
CAL-SD-02	711,448	1,11.,114	46.0	
CAL-SD-03	711,027	3,155,35..	47.9	
CAL-SD-04	731,577	3.155,656	49.2	
CAL-SD-05	735,225	3,157,774	44.0	
CAL-SL-01	732,777	3,157,929	50.2	
CAL-SL-02	732,647	3.158,224	50.7	
CAL-SL-03	733,639	3,157,966	51.3	
CAL-SL-04	734,697	3,157,867	51.1	
CAL-SL-05	734,250	3,157,622	50.1	
CAL-SL-06	735,...97	3,157,550	50.9	
CAL-SL-07	736,634	3,157,400	52.2	
CAL-SL-10	731,000	3,158,797	49.3	
CAL-SL-14	732,142	1,158,564	50.0	
CAL-SL-16	732,959	3,157,547	49.3	
CAL-SL-17	732,97[illegible]	3,157,559	50.1	
CAL-SL-19	732,9[illegible]5	3,155,000	50.2	
CAL-SL-20	733,3[illegible]7	1,157,800	51.0	
CAL-SL-21	734,560	3,157.650	51.5	
CAL-SL-22	733,400	3,155,080	50.5	
CAL-SL-23	733,406	1,158,277	50.1	
CAL-SL-24	733,[illegible]	3,155,200	50.7	
CAL-SL-25	733,595	3,155,000	51.9	
CAL-SL-26	73[illegible]59[illegible]	).157.355	51.2	
CAL-SL-27	734,960	3,157,375	50.9	
CAL-MW-01	732,152	3.158,563	50.4	52.3
CAL-MW-02	733,695	3. 157,796	51.3	53.5
CAL-MW-03	73[illegible]5[illegible]	3,157,963	49.1	51.6
CAL-MW-04	734,773	3,157,670	51.1	53.1
CAL-MW-05	735[illegible]3	3,157,557	51.0	51.1
CAL-MW-06	733,670	3,155,050		
CAL-MW-07				
CAL-MW-08	733,2[illegible]1	3,157,455	50.5	
CAL-MW-09				
CAL-MW-10	730,627	3,157,675		50.5
CAL-MW-11	731,400	3,155,750	49.6	51.5
CAL-MW-13	733,216	3,155,339		52.1
CAL-MW-14	733,720	3,155,200	50.2	52.5

SAMPLE LOCATION SUMMARY

PLATE 6-51

7.0 ENVIRONMENTAL SITE EVALUATION

The Environmental Site Evaluation presents the general air, soil, and groundwater quality findings at the proposed Cavalcade Yard site. Information and conclusions contained in this section are based on the data obtained from the Phase 1 and Phase 2 site investigation Rrograms. Our recollullended additional stUdies necessary to finalize the Phase 2 investigation and design analysis are outlined in Chapter 9.

7.1 Introduction

As discussed in Section 3.3, creosote waste products were encountered by McClelland Engineers during the Cavalcade Yard Reconnaissance Study. The preliminary Phase 1 investigation of the site was conducted to ascertain whether the site is contaminated *and* if"so to provide a basis for determining what additional work was necessary. Further work was conducted during the Phase 2 investigation to obtain information on subsurface contamination especially in the area of proposed building locations.

7.2 Air Quality

Air emissions from the Cavalcade Yard site produces no significant impact to contiguous areas. The site, located in greater Houston (Harris County), has an air quality conSIstent with other areas of the city. The site location is in an area classified as nonattalnment (not presently meeting natlonat ambient air quality standard - NAAQS) for both ozone and total suspended particulates. The Greater Houston area is classified as being in attainment for sulfur dioxide, nitrogen OXIdes and carbon monoxide. The existing trucking operations may contribute in small quantities to the nitrogen oxides and carbon monoxide levels.

Presently, no direct sources of air contamination from the previous *creo*sotlng and wood preserving operat;ons exist. All potential disposal and operations areas are presently covered with fill or vegetation. This provides a barrier which prevents direct contact between these potential sources and the air. Although waste products from this site contain OdOrous compounds that would degrade ambient air quality this barrier prevents diffusion of these compounds into the ambient atmosphere. Only upOn exposure of the underlying contaminated soils through investigation and/or construction activities could air quality degradation in the immediate area possibly occur. As discussed previously, the waste creosote products disposal at this site have been SUbjected to environmental degradation and as a result only refractory non-volatile compounds remain. As a result, no major concentrations of volatile organics which might influence the ambient atmosphere were detected. These compounds would not result in a signficant impact to local or regional air quality.

7.3 Sediment and Surface Water Contamination

Analytical results from sediment samples indicate some trace contamination but no significant health hazard. Concentrations of creosote products range as high as 109 ppm in the drainage ditch adjacent to the railroad on

along property ... railroad rather ... and CAV-SD-03) concentration ... Elsewhere ... Location ... prior wood treatin ... may relate range ... contamination ... to 10.4 ppm confirming there is localized ... of the drainage ditches.

There ... sediment ... overt

... products ... not ... contamination ... surface water ... not particularly ... related ... 0.1 ppm ... railroad ... product ... found along tracks ... to floating oil and spillage along the tracks.

an sediment sample ... an ... methylene chloride ... not ... ar ... only refractory organi found ... only ... metals found ... the sediment ... contaminants ... contr ... the exhibit hazardous waste ... eaching characteristics ... are cause for some concern because they may ... heavy ... No ... metals were detected ... Extraction Procedure ... surface water.

7.2 Shallow Groundwater and Soils Contamination

Visual an analytical data from the three ... borings an five observation wells completed during the Phase I investigation indicate that the shallow aquifer an subsurface soils underlying the site contain waste products from creosoting an wood preserving operations. The shallow aquifer consists of silty sand an fine sand and generally occurs within ... feet ... creosote products ... certain ... Section 5.2). Relatively high concentrations of ... sample o the shallow groundwater. ... other ... groundwater samples were ... from the rema ... seven observation wells installed during Phase ... and analyze ... of property access problems. Concentrations of creosote products ... because ... location CAV-SL-03 and CAV-SL-0 ... range ... so ... ppm at the ... surface an as high as 2,547 about 10 feet below the surface.

... and safety hazard ... indicate under the present conditions. The State regulatory position, with respect to protection of groundwater quality and hazardous waste management considers it essential to ... natural an exten ... potential for off site migration ... system an ... waste

Cavalcade Yard ... in the ... shallow observation wells ... and three shallow observation wells on ... about ... show consistent eas to west ... groundwater ... 20 feet per mile (see Plate 7-1). The influence of north o acetylene manufacturing exerted by ... hydraulic gradient ... direction of ... groundwater contours ... waste ... lagoon ... elevation ... the water ... site evident from the westward the st side ... the property, ... shallow ... temporal fluctuation ... the site and not confined ... predominant area and the trend of water level contours plant. In general, the groundwater is under unconfined conditions. The ... recharge ... source; short distance eas ... the acetylene

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presence of fine-grained materials (clays and silts) in the upper parts of most of the aquifer, however, serves to partially confine the groundwater, particularly under short-term conditions.

The configuration of the water table and the east to west direction of Ifoundwater flow is not conSistent from what would be inferred from consideration ot topography in the vicinity of the Cavalcade property and the locations of the drainage ditches into which shallow groundwater would discharge (Plate 5-4). The Cavalcade Yard site lies in the drainage basin of Hunting Bayou. As discussed in SectIon 5.4, the land surface in the vicinity of tne site slopes gently to the southeast and east toward Hunting Bayou. A shallow ditch, draining into a branch of Hunting Bayou, lies only about 500 feet north of the property. Another branch of Hunting Bayou, abut 10 feet deep. lies just over a half-mile east of the site. A drainage swale from the branch extends along Collingsworth Street to the south. LIttle White Oak Bayou is the nearest major drainage course on the west. But at a depth of 25 feet. It is also the deepest Bayou in the viclnity of the site. lhe drainage divide between Hunting and Little White Oak Bayous is oriented to the southeast and passes southwest of the site.

A projection of the groundwater surface beneath the Cavalcade Yard site (at a gradient of 20 feet per mIle to the west) to Little White Oak Bayou would just intersect the bottom of the closet proximity to the Bayou. But the projected surface would cross the drainage divide between Hunting and White Oak Bayous. Whl1e topographic and groundwater divides need not coincide, such a wide discrepency 1n orientation and position is unusual.

Because of its greater recharge potential, it is possible that a sandfilled channel (Pleistocene distributary channel) lying just east of the site and extending approximately north-south is influencing the water table con· fIguration more than surface drainage. No channel is shown on available detailed geologic maps. but it might easily have been missed or excluded because ot its small size and the extensive urbanization of the area. It is also possible that the current configuration and gradient of the shallow water table is not natural but is being influenced by artificial or transient sources east of the site. *lhe* data *are* insufficient to confirm this.

The only information available on the extent of contamination in the shallow aquifer at the proposed Cavalcade Yard site is the analysis performed for Observation Wells CAV-OW-1 and CAV-OW-2 and the visual and odor observatfons made during drilling of the seven additional shallow observation wells. This information indicates that:

- o Shallow groundwater in the vicinity of CAV-OW-02 is contaminated with creosote waste products. The concentration of the creosote products was 18 ppm. Volatile organics, including benzene, toluene and ethyl benzene which are typical of petroleum prOducts, and some other organics including pentachlorophenol were also found.

- a Groundwater from CAV-OW.Ol is also somewhat contaminated. The concentration of cyanide, however, suggests that at least some of the contamination is contributed by seepage from the waste disposal lagoon of the acetylene plant located to the east.

- o Shallow groundwater and soils in the vicinity of observation wells CAV-OW-10, CAV-OW-11, CAV·OW·13, and CAV-OW-14 also appear to be contaminated. CAV-OW-10 as clearly the most contaminated, CAV·OW·13 is the least contaminated.

Contamination of groundwater from CAV·OW-02 is related to the high levels of creosote waste products found in soil borings CAV-SL·03 and CAV.SL-04. Based on analyses of aerial photographs, it appears that the area near observation well CAV-OW-02 could potentially be a previous waste disposal area. This area has been subsequently disturbed and its boundaries and exact location are obscured. The high *degree* of contamination indiCated at well CAV-OW-10 suggests that this well also is in or adjacent to another major source of creosote waste products. Data are insufficient. however, to define the nature of this source.

The distribution of the shallow groundwater contamination indicated by the other shallow observatlon wells is not entirely consistent with the grounDwater flow regime. Except for well CAV-OW-10, all the wells in which contamination was detected are located on the upgradient (east) side of the property. As stated earlIer, some of the contamination of well CAV-OW-01 is from the waste disposal lagoon at the acetylene plant east of the Cavalcade Yard site.

The probable presence of creosote waste products in observation wells CAV-OW-01, CAV-OW-11, CAV-OW-13, and CAV-OW-14 suggests either that the sourCe is off the property; e.g., spillage along the railroad tracks east of the property, or that the present flow system is not the same as existed in the past when wood treating and preserving operations were active on the site. It does not appear, however, that under the present groundwater flow regime that any of the contaminants are being transported offsite as determined by observation wells CAV-OW-08 and CAV-OW-09, except possibly at the southwest corner of the Cavalcade Yard site. Considering the *age* of the wastes products and that the more volatile and mobile compounds would have already left the site. this is not unexpected.

Because the data do not appear entirely consistent and because Phase 2 work was not completed, it is dlfficult to assess the full impacts of past use of the Cavalcade site on the shallow groundwater. There are one or *more* places on the site which are serving as "sources· of contamination, Mate·rial excavated from these places are expected to reduce future groundwater contamination of the shallow aquifer. The site does not, however, appear to be contributing extensively to pollution of the shallow groundwater in *the* vicinity of the site.

7.5 Deep Groundwater

Because indications of contamination from creosote waste products were found at 40 ft below ground surface in soil borings CAV-SL-03 and CAV·$L·04 lind because of ,the sha11 Ow groundwater contamination, Texas Depal"tment of Water Resources (TDWRj requested the installation of a deep (200 ft) observation well. The purpose of the deep well was to ascertain whether contamination from the wood treating and preserving operations at the Cavalcade Yard site had migrated downward to the first usable aquifer. As discussed in Section 5.5, the first usable aquifer was taken to be the

shallowest aquifer known to yield water for domestic purposes. It was assumed that because yielo requirements from domestic wells are very small and because 01 cost consloerations. domestic users will tap the shallowest possible aquifer which is capable of yielding water of a suitable quality for a sustainable period. In the vicinity of the Cavalcade Yard site, the Shallowest aquifer known to be used fur domestic purposes is about 200 *feet* below the ground surface.

The deep observation well, CAV-OW-06, was installed to the southeast of 50\1 borings CAV-SL-03 and CAV-SL-04. The specific location was chosen because:

a) It was close to. and presumably downgradient. from the suspected disposal area.

b) It was oulside the inferred boundary of waste disposal area. thus reducing the possibilIty of drilling through buried wastes and Inadvertently carryIng contaminants downward.

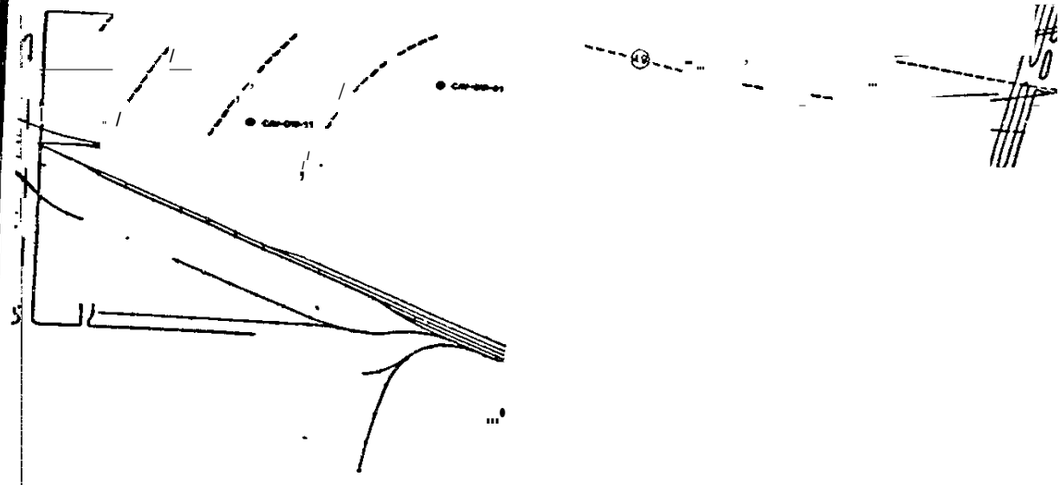
c) It was outSide the boundaries of any planned structures, reducing the possibility that the well would be destroyed during construction.

Installation and sampling procedures were developed according to detailed specifications (see Section 6.3). During drilling. all soil sanples reCovered were examIned vlsual1y and analyzed with an HNU photoionZier. Soi1 samples immediately above and below the target aquifer were assigned a complete priority pollutant analysis. A groundwater sample was collected after the well haa been completely developed by pumping for several days to permit a representative sample. A complete priority pollutant analysis was also assigned for the groundwater sample.

No visible contamination or odor was detected below about 60 feet. HNU readings continued to be high (2000 ppm) to as deep as 112 feet and as high as 400 ppm into the target aquifer. Priority pollutant scans of the soil samples above and below the target aquifer showed no detectable contamination. Analysis of the groundwater sample revealed that.toluene (49 ppb) was the only contaminant present that is possibly related to wood treating and preserving operations (49 ppb).

The available data suggest that groundwater in the "200 foot" aquifer has not contaminated by WOod treating or preserving operations on the Cavalcade Yard site and most likely has not been contaminated in the past. The presence of toluene. in the absence of other organic contaminants in both the well samples and soil boring samples collected during the installation of the well, is anomalous and in our opinion probably represents a contami. nant introduced from some source other than the site. Similarly, the high HNU readings appear to anomalous. The HNU device is a generic detector and simply responds to photoionizable compoundS with a disassociation energy equal to or less than ultraviolet lamp source, 10.2 eV. HNU readings are not specific to creosote wastes or even organic molecules. The specific cause of the high HNU readings observed during the installation of the well is not known. These values could be a result of any number of causes including. a response to naturally occurring organic compounds or a tranSient instrument malfunction. The cause of this anomaly should be

determined when the field stud1es are completed. In sUlMlary. 1t 1s our op1nion that the deep well sample should be retaken and analyzed and 1f Our Judgment holdS and the "deep" aquifer 1s not contam1nated then the s1te development 1n accordance with the recommended Remedial Act10n Plan should proceed.



LEGEND

PLATE 7-'

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HOUSTON, TEXAS

8.0 REMEDIAL ACTION PLAN

Remedial actions that are required for the Cavalcade Yard site address primarily the contaminated surface and groundwater encountered during future construction or during remedial activities at the site and the contaminated subsurface source materials. This section presents the objectives, identifies the potential remedial actions, evaluates these actions and recommends remedial actions for the Cavalcade Yard site.

8.1 Objectives

The objectives of this Remedial Action Plan are to:

a. prOVIde *positive* control over on-site surface water, rainfall runoff and groundwater to be handled during the construction activities associated with the proposed Cavalcade Yard facl)lties;

b. provIde protection for the workers at the proposed facility from exposure to the contaminants currently present on-site;

c. prOvIde on-site health and safety ffiJnitoring during all construction activities assOCIated with the site; and

d. monitor for off-SIte migration of contaminants from the shallow aqul fer.

8.2 Identify Alternatives

Tne following alternatives were identified to address the surface water, raInfall runoff and groundwater encounted during construction activities at the site.

- o No Action. Under this alternative surface water found on site and storm run-off would not be collected. It would be allowed to percolate into the ground or run off the site into the stormwater drainage system. Any groundwater that was pumped from dewatering operations during excavation would also be discharged directly to the storm drainage system.

- o Tank Truck Removal. Under this alternative surface water, collected storm run-off or groundwater from the site would be collected and transported off-site for disposal at an approved facIlity•

- o On-Site Treatment. Under this alternative surface water, collected run-off and groundwater would be treated on-site by an appropriate process. The unit processes may include air stripping, granular activated carbon adsorption, and precipitation. After treatment the water would be discharged to the storm water system.

- o Discharge to Sanitary Sewer. Under this alternative surface water, collected run-off and groundwater would be subjected to on-site

pretreatment, if required, and then discharged into the municipal sanitary sewer system. The level of pretreatment required would be established by the terms and conditions of an Industrial Waste Permit issued by the City of Houston.

The following alternatives were identified to address long term protection of the workers at the proposed facility from the contaminants "currently found on the site. The area of primary concern is the suspected disposal area located near the proposed operations building. Any groundwater encountered would be treated as described above.

- o No Action. Under this alternative the contaminated soils would remain on-site.

- o In-Situ Chemical Fixation. Under this alternative the contaminated soils woula be chemically fixed"and/or solidIfied in place to prevent theIr migration off-site and phySIcal *contact* with the population.

- a Incineration. Under this alternative contaminated soils would be burned in a high temperature incinerator. ThIS operation could take place at eIther an off-site approved facility or on-site using portable equipment.

- o Removal/uisposal. Under this alternative the contaminated soils would be excavated *and* all material having observable contamiantion would be dIsposed of at a permitted TDWR Class I facility. The excavation would be backfilled with uncontaminated material and capped with a minimum of three feet of compacted clay.

- o Excavation and On-Site Treatment. Under this alternative the contaminated soils would be excavated and renovated on-site. The soils would be subjected to microbial action to degrade the contaminants. ThIS activity would be encouraged by the addition of acclimated microorganisms water and food if necessary. The remaining sol ids would be used on site for fill or properly dIsposed of off-site, if required.

8.3 Evaluation of Alternatives

The evaluation of alternatives was based on a positive rating (+), a neutral rating (0) or a negative rating (-). In each category relative values were assigned based on an alternative's relative ranking compared to other alternatives in the particular category. A value of (+) indicates one alternative has significant advantages over the other alternatives for a particular category. Zero (0) indicates there is no particular advantage of one alternative over another, and (-) indicates a distinct disadvantage for an alternative compared with the others. A total of five ranking categories were evaluated for each alternative remedial action. These categories are:" reliability, ability to implement, technical effectiveness, environmental concerns, and safety. The results of this analysis are summarized on Plate 8-1 and discussed below.

PLATE 8-1

EVALUATION OF ALTERNATIVES

SURFACE RUNOFF & GROUNDWATER ALTERNATIVES	RELIABILITY	ABILITY TO IMPLEMENT	TECHNICAL EFFECTIVENESS	ENVIRONMENTAL CONCERNS	SAFETY
No Action	(-)	(-)	(-)	(-)	(-)
Tank Truck Removal	(+)	(0)	(+)	(+)	(+)
On-Site Treatment	(0)	(-)	(+)	(+)	(0)
Discharge to Sanitary Sewer	(+)	(+)	(+)	(+)	(0)
LONG TERM ALTERNATIVES					
No Action	(-)	(-)	(-)	(-)	(0)
In-Situ Chemical Fixation	(-)	(0)	(-)	(0)	(0)
Incineration	(+)	(0)	(0)	(+)	(+)
Removal/Disposal	(+)	(+)	(+)	(+)	(+)
Excavation and On site Treatment	(0)	(+)	(0)	(0)	(0)

NOTE: These values are not meant to be additive and should not be totaled.

LEGEND:
(+) Significant advantage over other alternatives
(0) No particular advantage
(-) Distinct disadvantage compared to other alternatives

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Surface, Runoff and Groundwater Alternatives

Reliability. Collection of the water during construction and either trucking the water to an approved off-site treatment facility or on-site treatlhent prior to discharging the water to the city sanitary sewer system would be the most reliable alternatives. In both cases the contaminated water would be contained and disposed of in a safe manner. Contamination would not be released into the environment. On-site treatment and discharge to the storm system is not as reliable because it would require a high degree of treatment and more complicated processes. This is necessitated by the fact that the discharge is not to a wastewater treatment system but to drainage and the river. The least reliable alternative is the no action "alternative that provides no protectioll against the migration of the contaminants.

Ability to Implement. Oischarge of surface water, storm water runoff and collecteo groundwater to the sanitary sewer would be the easiest to implement. The pretreatment system would utilize standard processes to satisfy the Sewer pretreatment standards. Trucking the water would be quIte appropriate tor heavily contaminated water. but large quantIties of water pumped during well point operations for excavations could overload thIS system. lhe quantIty uf water could be too great to transport in this manner. Public and city opposition to both the no action alternative and the on-site treatment with dIscharge to the storm drainage systpm could make their impOSSIble to implement. The city has stated that discharge to the storm drainage systems would not be allowed.

Technical Effectiveness. From a technical perspective it is possible to transpoi: the waste water to an approved facility or treat it on site and dlscnarge it to the sanitary sewer. They both use existing and proven technIcal methods of treatment. Treatment processes would probably include aIr strIpping, granular activated carbon, and precipitation. On-site treatment and discharge to the storm system requires a greater level of treatment because of the method of final disposal and therefore is not as desirable. lhe no-action alternative is not Sound technically and allows the wastes to remain in their present condition.

Environmental Concerns. Tank truck removal, treatment and discharge to the sanitary sewer system and treatment and discharge to the storm sewer system all present environmentally effective solutions to the problem. The waste water is contained, treated and disposed of in an effective manner.

The no-action alternative is not an appropriate response to protect the environment. If not contained or treated the contaminated water will run-off the site and spread the contaminants outside the site boundaries. lhis would only accelerate the environmental degradation caused by the contaminants at the site.

Safety. The most favorable alternative for safety is to truck the wastewater off-site. This alternative does not require an on-site treatment system or extensive contact with the water. Both on-site treatment alte natives utilize conventional unit processes but require controlled safety procedures because of the type of wastes that are being handled and treated. The least acceptable alternative is *the* no-action

alternative. Raw. untreated water would be discharged and the possibility for contact with human receptors would be the greatest.

Source Control Alternatives

Reliability. Incineration and the removal/disposal alternatives are the most reliable methods of disposing of the contaminated Salls since in both cases the technology is available and proven. The inCineration process will effectively destroy the organics. The remaining ash and metals can be placed in a Class I landfill. Removal will also include any pretreatment required by the disposal facility and then off-site disposal of the wastes in a Class 1 facility. On-site treatment. possibility by microbial activity will treat the wastes. After treatment the residue can be disposed of in a municipal landfill. This methodology has been successfully applied in a limited number of applications and is not yet widely accepted. Chemical fixation is generally effective in demobilizinq metal wastes but is generally not effective in the stabilization of orgaric wastes - particularly over the long term. The no-action alternative is not reliable and the present migration of wastes through the groundwater plume would continue because the source would still be active.

Ability to Implement. Removal/disposal and the on-site treatment alternative *are* the easiest to implement. They both require conventional construction procedures. It is not certain if the off-site disposal will require fixation prior to transporting the wastes. Even if this is the case. the process should be easy to implement. Incineration would be more difficult to implement - primarily due to excessive costs and permitting requirements, The majority of the contaminated material is not combustible - rather it is inert soil. Therefore. the wastes are probably not capable of being burned without an outside source of fuel. This becomes very costly and the process would result in large quantities of ash that will probably require disposal in a Class I landfill due to the high metal content. Chemical fixation on site would probably not be desirable because the potential for organic contaminant migration would still exist over the long term. The no action alternative is not acceptable because nothing has been done to alleviate the migration of the contamination already present at the site.

Technical Effectiveness. The removal/disposal alternative presents the most widely proven technology for dealing with the type of wastes present at the site. Incineration and on-site treatment are both technologies that have application but a large percentage of the contaminated materials are not combustible and microbial applications have been limited in number and scope. The technology associated with chemical fixation as a permanent solution to organic migration has not been proven effective to date. therefore, this alternative and the no-action alternative which does nothing to the source materials are not desirable technically.

Environmental Concerns. Environmentally the most effective and complete alternative is the removal/disposal option. It removes the source of contamination from the area so that additional contaminants are not introduced into the groundwater. It then places these materials in a secure Class I facility where it,will be isolated from the environment. Incineration also removes the wastes from the source area. There is *an*

added concern of air emissions from the combustion process but the technology exists to deal with those emissions. The ash material would then be placed in a secure Class I facility. On-site treatment would require exposure of the waste materials to the air. Any volatile organics present would be given off into the air which may affect air quality in the area. AddItionally. there is the questfon of when does biological treatment stop and what effect would the remaining contamtnants have after being placed ina municipa1 1andfilJ. Chemica1 fixatiOn is not very effective on organics and they would continue to migrate off-site. although the rate of organics beIng released would probably be less than at the present time. lhe current situation has caused environmental degradation ànd the no-action alternative would do nothlng to alleviate this situation and therefore it is not responsive.

Safety. Removal/disposal and incineration *are* both alternative that use proven processes that are safe. There should be no danger for public or worker safety due to these treatment processes. fixation and on-site treatment are relatively safe operations. but in both alternatives the wastes remaln on-site for a periOd of time. This increases the possibility ot contact with the public especially for the microbial treatment which will require spreading the wastes in the open *tor* an extended period of time while the biological activity is taking place. While the present sltuatl0n is not unsafe. the no-action alternative does nothing to protect the safety of potential downgradient receptors of the contaminated plume and therefore is not responsive.

8.4 Conclusions

The surface water. run-off and groundwater alternative actions that received a generally favorable evaluation were the tank truck removal *and* pretreatment followed by discharge to a sanitary sewer. The on-site treatment with discharge to the storm drain system was generally neutral and the no-action alternative was negative in the evaluation. The tank truck removal will probably prove to be most effective in dealing with so,all quantities of highly contaminated wastes. If the quantities are large and *lor* the concentrations of contaminants are low. then it will probably be more effective to use pretreatment *and* discharge to the sanitary sewer system.

For the SOurce control alternatives. the removal/disposal alternative received the most positive evaluation. Incineration and on-site biological treatment were also positive but were either questionable or not totally appropriate in some areas. In-si(u chemical fixation and the no·action alternative were considered to be inappropriate for this site. The removal/disposal alternative is a proven. effective method for dealing with the type of wastes on the site. However. if a treatment standard or disposal standard test can be established for these wastes, then this alternative could become much more viable *tor* the Cavalcade Yard site.

8.5 Proposed Remedial Action

Based on discussions with TDWR. a Pleliminary Cleanup Plan was proposed for the site as shown on Plates B-2a to 8-2c. This plan was responded to in a proposed remedial action program to TVWR dated May 17. 1983. and is shown

on Plates 8-3a to 8-3f. TDWR responded to the remedial program in a dated June 2, 1983, shown on Plates 8-4a to 8-4b. The proposed program has been amended as suggested by TDWR and is summarized in the following paragraphs.

1. On-site surface water, collected runoff, and groundwater encountered during construction will be pretreated, if required, and discharged into the munlcipal sanltary sewer system in accordance with the terms ana conaitlons of an Industrial Waste Permit to be obtained from the City ot Houston.

2. The Suspectea creosote waste disposal area located near the operations bUilaing wl11 be excavated to a depth between seven (7) and twelve (12) feet to remove all material having observable contamination, defined as visual stains or noticeable creosote Odors. The excavation will be backfllled with uncontaminated material and capped with a minimum of three (3) feet of compacted clay having a p rmea 1 ity equa -to or less than 1 x 10⁻⁷ cOl/sec. The excavated material will be disposed of in a permitted TDWR Class I lanafill.

3. Other areas of observable soil contamination (as defined above) unearthed during construction shall be addressed using one or a Combination of the followlng remedial measures.

   a. The contaminated material Shall be removed as disposed of as a Class I wasle.

   b. The contaminated material shall be capped using a mInImum of 18 inches of compactea clay as specified in Item I.

   c. The contamlnated material shall be capped using a minimum of four (4) inches of bituminous concrete or portland cement concrete placed 1n accordance with standard construction practice.

   d. The contaminated materials Shall be capped using an acceptable synthetic liner installed in accordance with the manufacturer's recommendations and stabilized with a suitable cover material (less than 18 inches).

All grading associated with construction in these areas will provide positive surface drainage to a collection system.

4. Observably contaminated sediments and soils containing free liquid Shall be dewatered on-site by spreading on an impermeable surface, i.e. a synthetic liner in a bermed area or pavement. Such sediments and soils could also be solidified onsite if the dewatering pilot testing indicated potential problems. Free liquids collected will be disposed of in' accordance with Item 1. The drained material shall be disposed of as a Class 1 waste. The resulting excavations shall be backfilled with Suitable material and capped as specified in Items 3b. C, or d.

5. The initial groundwater monitoring program shall consist of one-time monitoring for priority pollutants from eight observation wells. Once thi s data has been evaIuated, a quarterly p'ogram sha11 be imp Iemented.

This program shall consist of monitoring one upgradient well and three downgradient wells quarterly for one *year.* Parametric coverage will be dependent on a review of the initial program analyses. At the end of one year of monitoring, TDWR will evaluate the data and decide what type of program will *be* required in the future.

6. All closure activities associated with the above program **will** be certified and directly supervised by a professional engineer.

7. Upon acquisition of the aforementioned properties, a statement will be recorded on the *deed* notifying any potential purchaser of the properties that the land has been used for the disposal of wood preserving waste materials.

Preliminary Cleanup Plan for the
Cavalcade Creosote Site

I. Surface Water and Sediment

A. Water

1. Remove all water from areas A & B and any other areas on site where water is contaminated.

2. Water contaminated with hazardous waste should be disposed of at a Class I site.

3. Uncontaminated water disposal will be left open; however, it cannot be discharged without a permit.

B. Sediment

1. Sediments should be removed to a point where there IS no observable contamination ... i.e. to, visual stains or noticeable odors.

2. Since this sediments have the hazardous waste number (K001), they must be disposed of at a Class I site. Constituents which make these sediments hazardous are as follows:

chrysene	indeno (1,2,3-cd) pyrene
naphthalene	benz (a) anthracene
fluoranthene	dibenz (a) anthracene
benzo (b) fluoranthene	acenaphthalene
benzo (a) pyrene	

C. Closure

1. These areas should be filled with uncontaminated earth and a final cover of 3 feet of compacted clay should be applied and graded to a crown (allow for settling). In regard to clay, the following parameters should be met:

(a) permeability (cm sec) $\leq 1 \times 10^{-7}$
(b) % passing No. 200 sieve ≥ 30
(c) liquid limit ≥ 30
(d) plasticity index ≥ 15

2. The surface areas should be stabilized with a vegetative cover.

3. A concrete cover may be substituted for items and 2.

4. All closure activities should be certified by a professional engineer.

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II. Surface and Subsurface Soils

A. Areas F, L, and otller areas where minor contamination is suspEcted.

I. Soils from these areas should be removed to a depth of 6 inches.

2. Disposal shall be at a proper site which will be determIned by sample analysis.

3. A concrete or compacted clay cover can be substituted for items and 2.

B. Area N

I. Soils should be excavated to a depth of 12 *feet* and be disposed at a Class I site.

2. Closure shall be in the same mannel' as I-C.

C. Area M

1. Soils should be excavated to a depth of 7 feet and be disposed at a Class I sIte.

2. Closure shall be in the same manner as I-C.

III. Contamination encountered during construction and'or remedial actIvitIes.

A. Any areas encountered should be dealt with in the same manner as II . A, B, or C depending on the degree of contamination.

6. Closure shall be in the same manner as I-C.

IV. Ground water

A. Ground water mcnitonng wells

I. A sufficient nllmber of cluster wells shoulc be Installed surrounding the site to be used Initiall) to determine the direction and rate of g,ollnd water flow.

(a) Cluster wells shall consist of a deep and shallow well located adJaccrlly.

(1) Shallow wells should be screered at the bcttcm ten feet of the first water bearing crit.

(2) Deep wells should be screened at the bottom ten feet of the second water bearing unlt (approx. 200 feet!.

(b) Logs ot the borings and monitor well installation diagrams should be provided.

2. Once the direct Ion and rate of ground wate' flow is determined and samples have been analysed, additional wells may be required.

3. Samples shall be collected on a quarterly basis and analyzed for chemical parameters to be specified by Texas Department of Water Resources (TDWk) for an unspecified period of tlme In the future.

4. Appropriate geohydrologic analyses should be performed to determlred if the upper aquifer is lsoldtej from the *one* below it by a sufficiert thicfness of clay to mitigate any hazard to the regional aquifer.

5. Ground water recovery or slurry walls or other remedial measures may be required upon review of the g-ound water data.

V Deed Record

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METRO

"."opoht.n ".";s,1 Authority
P. O. ...
... Street
Houston, Texas 77208-...
713 225 1151

May 17, 1983

Mr. Seth C. Burnltt
Deputy Director
Texas Department of
Water Resources
P. O. Box 13067
Austin, Texas 78711

Subject: Proposed Contamination
Remedial Action Program
Cavalcade Yard & Shop Site
METRO-STAGE O:IE, Regional Rail System

Dear Mr. Burnitt:

The Metropolitan Transit Authority of Harris County (METRO) previously informed the Texas Department of Water Resources (TDWR) that it is anticipating the acquisition of tracts of land lr ... ton fnr METRO's Cavalcade Yard & Shop facility. The tracts ... approximately by the HB&T Railway Company rail lines on the east and west, and by Cavalcade and Collingsworth Streets on the north and south, respectively.

METRO became aware that this site was formerly used by Koppers Company Tnc., and other companies for wood preserving and creosoting operations after contaminated soils and groundwater, related to the creosoting operations, were discovered during METRO's reconnaissance drilling program being conducted by McClelland EnJineers, Inc. (MEl). MEl and their environmental consultants, Camp Dresser & McKee Inc. (CDM), have been e\'aluating the extent of contamination on this site due to the past wood preserving and creosoting actiVities and/or on-site migration. As discusseJ with you at our meeting of March 11, 1983, this evaluation has required extensive field investigation, s.1mpling and analysis. The summary results of these efforts were presented at that time. The detailed analytical results were transmitted to your staff on March 12, 19B3. Based upon the evaluation of the results of this study by Camp Dresser & McKee Inc. and McClelland engineers. Inc., METRO is proposing the following program of remedial action for your review and approval:

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1. On-site surface water, collected runoff. and groundwater encountered during construction will be pretreated, If required, and discharged into the municipal sanitary sewer system in accordance with the terms and conditions of an Industrial Waste Permit to be obtained from the City of Houston.

2. Areas M & N, as shown on Plate 1. will be excavated to depths of seven (7) and twel"e (12) ieet respectively to remove all material having observable contamination, defined as visual staIns or noticeable creosote odors. The excavation will be backfilled with uncontaminated material and capped with a minimum of three (3) feet of compacted clay having a permeability equal to or less than I x lu-^{7} em/sec. The excavated material will be disposed of in a permitted TDWR Class III landfill or a Type I municipal landfill permitted by the Texas Department of Hea.th.

3. Other areas of observable soil contamination (as defined above) unearthed during construction shall be addressed using one or a combination of the following remedial measures:

   a. The contaminated material sllall be removed as disposed of as d Class fjl or Type I waste (See Item 21.

   b. The contaminated material shall be capped using a minimum of 18 inches of compacted clay as specified above.

   c. The contaminated material shall be capped using a minimum of four (4) inches of Lituminous concrete or portland cement concrete p: IC(:\ in accordance with standard construction practice.

   d. The contaminateJ material shall be capped using an acceptable synthetic liner installed in accordance with manufacturers recommendations and stabilized with a suitable CO\'cr material (less than 18 inches).

All grading ilssociated with construction in these areas will provide positive surface drainage to a collection system.

4. Observably contaminated sediments and soils containing free liquid shall be drained on-site by spreading on an impermeable surface, **i.e.** a synthetic liner **in a** bermed area. Free liquids collected will be disposed of in accordance with Item 1. The drained material shall be disposed of as a Class III or Type I waste (See Item 2). The resulting excavations shall be backfilled with suitable material **and** capped as presented in Item **3b, c, or d.**

5. A groundwater monitoring program will be initiated for the upper sand aquifer within 30 days of completion of the excavation of areas M • N as presented in Item 2. Two groundwater monitoring wells, one upgradient and one downgradient, will be sampled and analyzed for the parameters specified in Appendix 1 at a frequency of 90 days, for a period of one year. The use of one or more existing on-site wells will be considered for this monitoring program. The duration of the monitoring program will be based on attenuation of the off-site migration of the contamination in the upper sand aquifer resulting from the proposed remedial actions with respect **to** existing conditions. The following criteria will be used to determine when the groundwater monitoring program will be terminated or if additional groundwater monitoring action may be required:

   a. Existing conditions will be defined as the cumulative sum of the creosote contaminants as listed in Appendix 1 in a representative downgradient well to be installed in the upper sand aquifer.

   b. If during the first year of sampling and analysis, the cumulative sum of the creosote contaminants in a representative down-gradient well, less existing conditions as defined in Item 5a, is less than 1 ppm in any two (2) successive sampling rounds, then the monitoring program will be terminated.

   c. If during the first year of sampling and analysis, the cumulative sum of the creosote contamints in the representative downgradient well, less existing conditions as defincd in Item 5a, is not less than 1 ppm in any two (2) successive sampling roundS, then the monitoring program will be continued and additional remedial action will be considered taking *into* account upgradient conditions.

d. For the purpose of calcuL1ting the cumulative sum of creosote contaminants, OOL (below detection limits) will be considered as zero (0) contribution.

If the groundwater monitoring program is terminated based upon the above, then no additional remejial action or monitoring shall be required by TDWR ether than as defined In this Remedial Action Plan for the use of the site for the purposes specified.

6. One deep groundwater monltorlng well (approximately 200 feet) shall be installed on-site in the vlcinity of areas M & N as shown On Plate 1. If the analyses of the samples from this well show no detectable creoSOte product contamination as listed in Appendix I, then no additional remedial action other than as defined in this Remedial Action Plan shall be required by TDWR for the use of this site for the purposes specified. If contamination is encountered then we reserVE' the option tn initiate addItional stujies to determine if off-site disposal practices In the vicinity of this site significantly contributed to the contamination in this aquifer.

7. All closure activities associated with the above program will be certified and directly supervised by a professional engineer.

8. Upon acqUIsition of the aforementioned properties, a statement will be recorded on the deed notIfying any potential purchaser of the properties that the land has been contaminated with wood preserving process ",'dstes.

We feel th3t this Remedial Action Program will provide for the development and use of this site in an environmentally sound matter. We appreciate Town's assistance in the *development* of this program for this site and look forward to a continued gooJ working relationship with your staff.

METRO wishes to extend an invitation to TDWR to conduct an on-aite inspection of the proposed Cavalcade Yard & Shop site and to further discuss the proposed contamination Remedial Action Program. Please notify Donald Stankovsky, lIouston Transit Consultants, (713) 871-0600, ext. 690 of the dates you would be available for this inspection and discussion.

ThIS letter serves as formal notice that when METRO does acquire tllis site. the necessary remedial and closure actions WIll be initiated by METRO In accordance with terms of the program agreed upon by METRO and TOWR.- This confirms METRO's verbal notification during tlle meeting of March 11. 1953 of METRO's anticipated acquisition and closure of this site. Should METRO decide not to purchase the site, no responsibility for site cleanup or closure activities would be assu;ned by METRO.

Very truly yours,

William D. Alexander
Assistant General Manager
Rail System Development

WDA : DFS : prr

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APPENDIX I

A. DEFINITION OF CREOSOTE WASTE PRODUCTS

Wood Preservation K001 - Federal Register **Vol. 45, No. 98,** Monday, May 19, 1980, Section 261.32

Bottom sediment sludge from the treatment of wastewaters from wood preserving processed that use creosote and/or pentachlorophenol.

B. BASIS FOR LISTING HAZARDOUS WASTES

Federal Register Vol. 45, No. 98, Monday, May 19, 1980, Appendix VII

benzene
benz(a)anthracene
benzo(a)pyrene
chrysene
4-nitrophenol
toluene
n.1phthalcne
phenol
2-chlorcphenol
2,4 dimethylphenol
2,4,6 trichlorophenol
pentachlorphenol
4,6-dinitro-o-cresol
tetrachlorophenol

Additional Compounds of concern to Texas Dept. of Water Resources (1 DWR)

fluoranthene
benzo(b)fluoranthene
indeno (1,2,3-cd)pyrene
dibenz(a)anthracene
acenaphthylene

0 2 0 0 0

TEXAS DEPARTMENT OF WATER RESOURCES
1700 N Congress Avenue
Austin, Texas

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June 2. 1983

Mr. William D, Alexander
Assistant General Manager
Rail System Development
Metropolitan Transit Authority
P. O. Box 61429
Houston, Texas 77208-1429

2000

Dear Mr. Alexander:

Re: Houston MTA/Cavalcade Site - Remedial Action Program

The Department has reviewed the Remedial Action Program for the Cavalcade site submitted May 15, 1983 and has the following comments:

Items 2, 3(a) and 4

Soils contaminated with creosote wastes will be classified as Class I non-hazardous since they were deposited prior to RCRA regulations. Disposal should be at a Class I site.

Item 5

The initial ground water monitoring program shall consist of one-time monitoring for priority pollutants from every well. Once this data has been evaluated, a quarterly program shall be implemented. This program shall consist of monitoring one updip well and three downdip wells Quarterly for one year. Parametric coverage will be dependent on a review of the initial program analyses. At the end of one year of monitoring, the Department will evaluate the data and decide what type of program will be required in the future.

With the exception of the items previously mentioned, the Department concurs with Metropolitan Transit Authority's Remedial Action Program for the Cavalcade site. The Department will contact Mr. Don Stankovsky to conduct a joint inspection and if you have further questions, please do not hesitate to contact Mr. MiChael Dick at 512/475:5516.

Sincerely yours,

Charles E. Nemir
[xecutlve Director

ccs: Mr. Don Stankovsky, Houston Transit Consultants
General Counsel's Office
Texas Department of Water Resources District 7 Office

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g.O RECOMMENDED FUTURE INVESTIGATIONS

During the Course of the study, work was terminated on the METRO-Siage One, Regional Rail *System.* As a result, work on the Cavalcade Contamination Study was also terminated before completion. The findings and conclusions presented herein were based on available information Obtained before the project was terminated. Additional work is required to provide more definitive conClusions. Areas of uncertainty still to which may pose a considerable influence on the site's general suitability and long-term environmental effects.

This section presents reCommended future investigations required to complete the stUdy. Co"plet10n of the additional tasks will provide the necessary information and recommenoations to implement Phase 3 _ the remedial actiOn prograr,.,

9.1 Recommended Work Tasks

The recommended work tasks reGuired to complete the stUdy are presented as fall ows:

a. Additional water level readings at the observation wells Should be made each month. This 1S required to more accurately determine the groundwater hYdrology at the site and will also aid in establishirlg representative upgradient and downgraolent conditions.

b. An additional observation well should be installed on the west side of the property to replace observation well CAV-OW-09 which was damaged. ThiS replacement is necessary to properly monitor downgradient condItions. Observation well CAV-OW-12 should also be installed on the east side of the property. Property access prublems prevented the installation of this well.

c. All eleven wells located on the site property should be initially sampled for complete priority pollutant analyses. Results of the sampling and the additional water level readings will be used to develop a long-term groundwater monitoring program.

d. Additional soil borings should be performed at the south end of the site. This area has not been explored because of property access problems. This is also the previous location of the major wood treating facilities. Boring information would be required for the excavation of the proposed retention area. Soil borings should also be performed at the proposed Cavalcade Station for the excavation of a pedestrian tunnel.

e. A ditCh reconnaissance should be performed to accurately determine which portions of the on-site ditches are visually contaminated and would therefore require cleanup. This information would be necessary to prepare the contract documents *for* the Remedial Action cleanup.

f. Additional exploration is required to more accurately determine the location and extent of the contaminated disposal areas requiring excavation and removal. This task may be performed by additional bor1ngs, probing, or excavating test trenches and inspection pits. ThIs information is required to reduce the amount of over-excavated materials to be disposed at a TDWR Class I hazardous waste facility.

g. Continued work with preparing detailed construction specifications for the site preparation and demolition contractor's is also recommended.

h. All additional work performed should be incorporated into a revised. flnal engineer"ing report.

I. Re-sample the deep well CAV-OW-06 to verify the toluene contamination.

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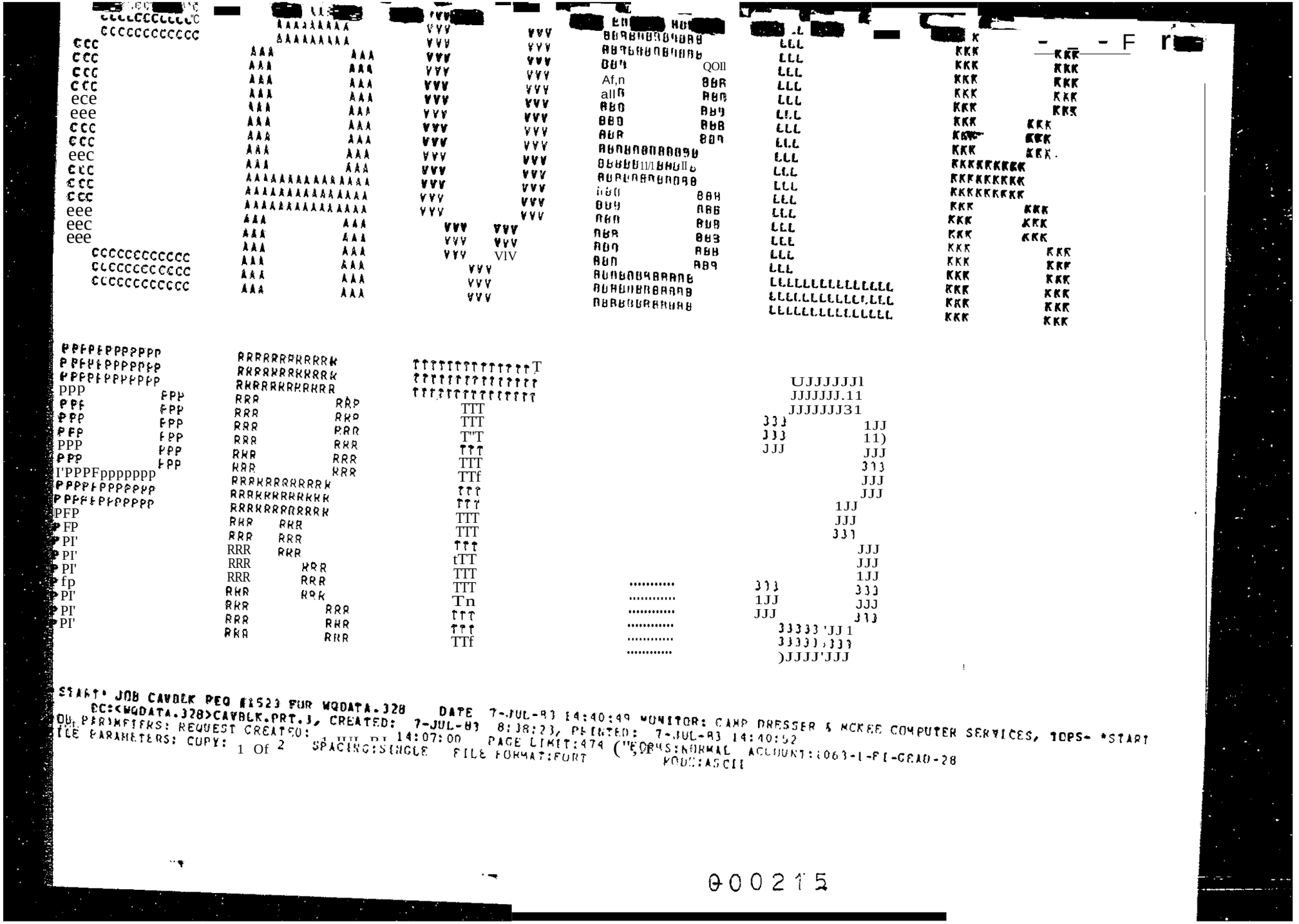

START JOB CAVBLK REQ #1523 FOR WQDATA.328 DATE 7-JUL-93 14:40:49 MONITOR: CAMP DRESSER & MCKEE COMPUTER SERVICES, TOPS- *START
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FILE PARAMETERS: COPY: 1 Of 2 SPACING:SINGLE FILE FORMAT:FORT MODE:ASCII

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WATER/SOIL QUALITY DATA

	OW-01	OW-02	OW-03	OW-04	OW-05
	FEB-08-1983	FEB-08-1983	FEB-08-1983	FEB-08-1983	FEB-08-1983
SAMPLER:	MEAD	MEAD	MEAD	MEAD	MEAD
SAMPLE NO.:	1II/0105	0W0204	OW03D3	OW040I	OW0502
SAMPLE SOURCE:	OW	UW	OW	O"	OW

VOLATILE ORGANICS UNITS: PPB

ACROLEIN	ND	NO	ND	NO	ND
ACRYLONITRILE	NO	ND	ND	ND	liD
BENZENE	NO	21.	63.	18.	ND
BIS(CHLOROMETHYL) ETHER	NO	NO	NO	ND	ND
BROMOFORM	ND	ND	NO	ND	ND
CARBON TETRACHLORIDE	NO	NO	NO	ND	ND
CHLORODBENZENE	NU	ND	ND	NO	NO
CHLORODIBROMOMETHANE	NO	ND	NO	ND	liD
CHLOROETHANE	NO	ND	ND	NO	PlU
2-CHLOROETHYL VINYL ETHER	ND	ND	NO	ND	ND
CHLOROFORM	ND	t,O	NU	NO	NO
DICHLOROBROMOMETHANE	NO	ND	ND	NO	NO
DICHLORODIFLUOROMETHANE	IIU	ND	NO	PlO	liD
1,1-DICHLOROETHANE	liD	ND	ND	ND	ND
1,2-DICHLOROETHANE	NO	ND	NO	ND	NO
1,I-DICHLOROETHYLENE	NO	ND	NO	ND	NO
1,2-DICHLOROPROPANE	liD	ND	NO	ND	NO
CIS-1,3-DICHLOROPROPYLENE	'O	ND	"O	ND	110
TRANS-1,3-DICHLOROPROPYLENE	ND	ND	ND	ND	ND
ETHYLBENZENE	ND	58.	68.	11.	ND
IIROHOHETHANE	ND	ND	ND	NO	liD
CHLORIIMETHANE	NO	ND	NU	ND	ND
METHYLENE CHLORIDE	ND	ND	ND	NC	ND
1,1,2,1-TETRACHLORDETHANE	NO	NO	NO	ND	ND
TETRACHLOROETHYLENE	NO	ND	NO	ND	ND
TOlliEIIE	ND	110.	130.	30.	110
1,2-TRANS-DICHLOROETHYLENE	ND	NO	ND	ND	ND
1,1,1-TRICHLOROETHANE	ND	ND	NC	rlO	"O
1,1,2-TRICHLOROETHANE	NU	ND	ND	ND	ND
TRICHLOROSTHYLENE	ND	ND	ND	ND	ND
TRICHLOROFLUOROMETHANE	ND	ND	HO	rlD	110
VINYL CHLORIDE	ND	ND	NU	ND	ND

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WATER/SOIL QUALITY DATA

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ALL RESULTS FOR THIS PAGE ARE FOR LOCATION 06-06

	FEB-08-1983	MAY-11-1983	MAY-11-1983	MAY-26-1983
SAMPLER:	JLAD	CLJR	CDH	CDH
SAMPLE NO.:	0406G3	0506G11	0M0619	0506G01
SAMPLE SOURCE:	GW	LPT	GW	GW

VOLATILE ORGANICS UNITS: PPB

ACROLEIN	ND	ND	ND	NO
ACRYLONITRILE	ND	ND	ND	ND
BENZENE	74.	ND	ND	ND
BIS(CHLOROMETHYL) ETHER	ND	ND	ND	1,0
BROMOFORM	ND	ND	ND	ND
CARBON TETRACHLORIDE	/10	ND	NO	ND
CHLOROBENZENE	ND	1,0	"O	/10
CHLORODIBROMOMETHANE	ND	ND	ND	ND
CHLOROETHANE	ND	ND	ND	ND
2-CHLOROETHYL VINYL ETHER	ND	ND	ND	ND
CHLOROFORM	ND	ND	ND	ND
DICHLOROBROMOMETHANE	ND	ND	ND	ND
DICHLORODIFLUOROMETHANE	ND	ND	ND	ND
1,1-DICHLOROETHANE	ND	ND	ND	ND
1,2-DICHLOROETHANE	':0	ND	I.O	ND
1,1-DICHLOROETHYLENE	ND	ND	ND	110
1,2-DICHLOROPROPANE	ND	ND	ND	ND
CIS-1,3-DICHLOROPROPYLENE	ND	ND	ND	ND
TRANS-1,3-DICHLOROPROPYLENE	ND	ND	ND	ND
ETHYLBENZENE	"O	ND	ND	ND
BROMOMETHANE	72.	ND	ND	ND
CHLOROMETHANE	ND	ND	NO	ND
METHYLENE CHLORIDE	NO	ND	HV	ND
1,1,2,2-TETRACHLOROETHANE	/10	1.0	I/O	ND
TETRACHLOROETHYLENE	ND	ND	ND	ND
TOLUENE	150.	ND	NO	ND
1,2-TRANS-DICHLOROETHYLENE	ND	ND	110	49.
1,1,1-TRICHLOROETHANE	/10	ND	ND	I/O
1,1,2-TRICHLOROETHANE	NO	I;0	ND	ND
TRICHLOROETHYLENE	ND	flO	ND	r/O
TRICHLOROFLUOROMETHANE	ND	1.0	110	ND
VINYL CHLORIDE	ND	ND	ND	ND
			NC	ND

000217

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WATER/SOIL QUALITY DATA

	PW-01	PW-02	PW-03	PW-04
	FEB-23-1983	FEB-23-1983	FEB-23-1983	FEB-23-1983
SAMPLER:	MEAD	MEAD	MEAD	MEAD
SAMPLE NO.:	PW0101	PW0202	PW0303	PW0404
SAMPLE SOURCE:	PW	PW	PW	PW

VOLATILE ORGANICS UNITS: UG/L

ACROLEIN	ND	ND	ND	110
ACRYLONITRILE	ND	ND	ND	ND
BENZENE	ND	ND	ND	ND
BIS(CHLOROMETHYL) ETHER	ND	ND	ND	ND
BROMOFORM	liD	ND	ND	110
CARBON TETRACHLORIDE	ND	1,0	ND	ND
CHLOROBENZENE	NO	1.0	ND	/10
CHLORODIBROMOMETHANE	ND	ND	NO	tlO
CHLOROETHANE	110	ND	ND	ND
2-CHLOROETHYL VINYL ETHER	ND	1,0	110	ND
CHLOROFORM	ND	ND	ND	ND
DICHLOROBROMOMETHANE	NI	ND	ND	ND
DICHLORODIFLUOROMETHANE	ND	ND	ND	ND
1,1-DICHLOROETHANE	ND	.O	ND	liD
1,2-DICHLOROETHANE	NU	ND	110	ND
1,1-DICHLOROETHYLENE	ND	ND	110	110
1,2-DICHLOROPROPANE	110	ND	NO	ND
CIS-1,3-DICHLOROPROPYLENE	ND	ND	III/	ND
TRANS-1,3-DICHLOROPROPYLENE	ND	ND	ND	ND
ETHYLBENZENE	ND	ND	ND	ND
BROMOMETHANE	NO	ND	liD	ND
CHLOROMETHANE	ND	ND	ND	1.0
METHYLENE CHLORIDE	ND	ND	ND	110
1,1,2,2-TETRACHLOROETHANE	ND	.O	110	ND
TETRACHLOROETHYLENE	ND	110	ND	ND
TOLUENE	ND	ND	ND	ND
1,2-TRANS-DICHLOROETHYLE-If.	NO	1.11	ND	ND
1,1,1-TRICHLOROETHANE	ND	ND	ND	ND
1,1,2-TRICHLOROETHANE	ND	ND	NO	NO
TRICHLOROETHYLENE	ND	ND	ND	ND
TRICHLOROFLUOROMETHANE	ND	ND	ND	ND
VINYL CHLORIDE	ND	ND	ND	NO

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WATER/SOIL QUALITY DATA

	SD-01	SD-02
	FEB-02-1983	FEB-01-1983
SAMPLER:	* HEAD	HEAD
SAMPLE NO.:	SD0108	SD0207
SAMPLE SOURCE:	SD	SD

VOLATILE ORGANICS UNITS: PPB

ACROLEIN	ND	ND
ACRYLONITRILE	ND	ND
BENZENE	ND	ND
BIS(CHLOROMETHYL) ETHER	ND	ND
BROMOFORM	ND	ND
CARBON TETRACHLORIDE	ND	ND
CHLOROBENZENE	ND	ND
CHLORODIBROMOMETHANE	ND	ND
CHLOROETHANE	ND	ND
2-CHLOROETHYL VINYL ETHER	ND	ND
CHLOROFORM	ND	ND
DICHLOROBROMOMETHANE	ND	ND
DICHLORODIFLUOROMETHANE	ND	ND
1,1-Dichloroethane	ND	ND
1,2-DICHLOROETHANE	ND	ND
1,1-DICHLOROETHYLENE	ND	ND
1,2-DICHLOROPROPANE	ND	ND
CIS-1,3-DICHLOROPROPYLENE	ND	ND
TRANS-1,3-DICHLOROPROPYLENE	ND	ND
ETHYLBENZENE	ND	ND
METHYLBROMIDE	ND	ND
CHLOROMETHANE	ND	ND
METHYLENE CHLORIDE	100.	48.
1,1,2,2-TETRACHLOROETHANE	ND	ND
TETRACHLOROETHYLENE	ND	ND
TOLUENE	ND	ND
1,2-TRANS-DICHLOROETHYLENE	ND	ND
1,1,1-TRICHLOROETHANE	ND	ND
1,1,2-TRICHLOROETHANE	ND	ND
TRICHLOROETHYLENE	ND	ND
TRICHLOROFLUOROMETHANE	ND	ND
VINYL CHLORIDE	ND	ND

000219

**** DRAFT **** CATALCADE YARD SITE **** DRAFT ****

WATER/SOIL QUALITY DATA

JUC-07-1983
08:39

	SD-03	SD-04	SD-05
SAMPLER:	FEB-02-1983	FEB-02-1983	FEB-01-1983
SAMPLE NO.:	MEAD	MEAD	MEAD
SAMPLE SOURCE:	SD0110	SD0411	SD0506
	SO	SO	SO
VOLATILE ORGANICS UNITS: PPB			
ACROLEIN			
ACRYLONITRILE	"O	NO	ND
BENZENE	NO	NO	ND
BIS(CHLOROMETHYL) ETHER	NO	NO	NO
BROMOFORM	ND	NO	ND
CARBON TETRACHLORIDE	NO	NO	ND
CHLOROBENZENE	ND	NO	ND
CHLORODIBROMOMETHANE	NE	NO	ND
CHLOROETHANE	NO	NO	NO
2-CHLOROETHYL VINYL ETHER	NO	NO	NO
CHLOROFORM	ND	NO	EO
DICHLOROBROMOMETHANE	NE	NO	NO
DICHLORODIFLUOROMETHANE	ND	NO	ND
1,1-DICHLOROETHANE	ND	NO	110
1,2-DICHLOROETHANE	NO	NO	NO
1,1-DICHLOROETHYLENE	ND	NO	ND
1,2-DICHLOROPROPANE	ND	NO	NO
CIS-1,3-DICHLOROPROPYLENE	110	NO	ND
TRANS-1,3-DICHLOROPROPYLENE	ND	110	ND
ETHYLBENZENE	NO	NO	ND
BROMOMETHANE	110	NO	NO
CHLOROMETHANE	NO	NO	NO
METHYLENE CHLORIDE	"O	NO	ND
1,1,2,2-TETRACHLOROETHANE	8J,	110.	39.
TETRACHLOROETHYLENE	ND	NO	ND
TOLUENE	NO	NO	ND
1,2-TRANS-DICHLOROETHYLENE	NO	NO	ND
1,1,1-TRICHLOROETHANE	ND	NO	NO
1,1,2-TRICHLOROETHANE	NO	NO	ND
TRICHLOROETHYLENE	NO	NO	NO
TRICHLOROFLUOROMETHANE	ND	NO	NO
VINYL CHLORIDE	ND	NO	ND

000220

000220

WATER/SOIL QUALITY DATA

	SL-01	SL-02	SL-03	SL-03	SL-03
	HII-01-IQ81	FEB-01-1983	FEB-01-1983	FEB-01-1983	FEB-03-1983
SAMPLER:	MEAD	MEAD	MEAD	MEAD	MEAD
SAMPLE NO.:	SL0101	SL0202	SL0302	SL0103	SL0301
SAMPLE SOURCE:	SL	SL	SL	SL	SL

BASE NEUTRALS UNITS: prj

ACENAPHTHENE	'10	ND	ND	ND	780.
ACENAPHTHYLENE	ND	ND	280.	ND	2400.
ANTHRACENE	ND	ND	1000.	ND	12000.
BENZIDINE	ND	ND	110	NO	liD
BENZO(A)ANTHRACENE	200.	LD	5600.	ND	32000.
BENZO(A)PYRENE	ND	ND	2000.	ND	21000.
3,4-BENZOFLUORANTHENE	260.	ND	6900.	ND	<bOOO.
BENZO(G,H,I)PERYLENE	ND	ND	1600.	ND	7200.
BENZO(K)FLUORANTHENE	260.	LD	6900.	ND	46000.
BIS(2-CHLOROETHOXY)METHANE	'10	ND	ND	ND	"0
BIS(2-CHLOROETHYL) ETHER	CO	ND	ND	NO	ND
BIS(2-CHLOROISOPROPYL) ETHER	ND	ND	ND	ND	'10
BIS(2-ETHYLHEXYL) PHTHALATE	ND	ND	ND	ND	110
4-BROMOPHENYL PHENYL ETHER	ND	ND	NU	ND	ND
BUTYL BENZYL PHTHALATE	ND	ND	IIU	ND	110
2-CHLORONAPHTHALENE	ND	ND	ND	ND	'IU
4-CHLOROPHENYL PHENYL ETHER	ND	itO	NO	ND	dID
CHRYSENE	200.	ND	4600.	ND	42000.
DIBENZO(A,H)ANTHRACENE	110	ND	IIU	ND	110
1,2-DICHLOROBENZENE	ND	ND	ND	110	ND
1,3-DICHLOROBENZENE	110	ND	ND	ND	IIO
1,4-DICHLOROBENZENE	ND	ND	NO	ND	ND
3,3'-DICHLOROBENZIDINE	NO	ND	NO	ND	ND
DIETHYL PHTHALATE	ND	ND	ND	ND	ND
DIMETHYL PHTHALATE	NO	ND	NO	UO	ND
DI-N-BUTYL PHTHALATE	NO	ND	ND	110	ND
2,4-DINITROTOLUENE	NO	ND	NO	liD	Nil
2,6-DINITROTOLUENE	ND	ND	NO	ND	'/0
DI-N-OCTYL PHTHALATE	ND	II.	/10	ND	ND
1,2-DIPHENYLHYDRAZINE	ND	ND	ND	I/O	'10
FLUORANTHENE	ND	ND	24000.	110	120000.
FLUORENE	ND	dID	ND	ND	980.
HEXACHLOROBENZENE	liD	ND	NO	110	,'liD
HEXACHLORODUTADIENE	ND	ND	ND	ND	ND
HEXACHLOROCYCLOPENTADIENE	ND	ND	NO	ND	'10
HEXACHLOROETHANE	dID	ND	NO	ND	'10
INDENO(1,2,3-C,D)PYRENE	ND	ND	I ADO.	ND	7200.
ISOPHORONE	NO	ND	NO	ND	ND
NAPHTHALENE	ND	NO	ND	ND	1000.
NITROBENZENE	ND	1.0	ND	ND	ND
N-NITROSODIMETHYLAMINE	ND	ND	NO	/10	ND
N-NITROSODI-N-PROPYLAMINE	ND	110	ND	ND	'/0
N-NITROSODIPHENYLAMINE	NO	ND	ND	ND	ND
PHENANTHRENE	NO	IID	5000.	NO	20000.
PYRENE	10.	ND	20000.	ND	110000.
1,2,4-TRICHLOROBENZENE	ND	ND	NO	ND	"0

DRAFT

WATER/SOIL QUALITY DATA

ALL RESULTS FOR THIS PAGE ARE FOR LOCATION 51-04

	FEB-04-1983	FEB-04-1983	FEB-04-1983	FEB-04-1983
SAMPLER:	MEAD	MEAD	MEAD	MEAD
SAMPLE NO.:	SL0403	SL0404	SL0402	SL0401
SAMPLE SOURCE:	SL	SL	SL	SL

BASE NEUTRALS UNITS: PPB

ACENAPHTHENE	1'0000.	5\0.	160000.	100000.
ACENAPHTHYLENE	3200.	ND	NO	1OOO.
ANTHRACENE	4'JOOO.	590.	520000.	240000.
BENZIDINE	ND	ND	ND	NO
BENZO(A)ANTHRACENE	28000.	1 20.	27000.	17000.
BENZO(A)PYRENE	32000.	440.	7600.	4600.
3,4-BENZOFLUORANTHENE	7200.	J4G.	ILOOO.	10000.
BENZO(G,H,I)PERYLENE	2200.	ND	NO	ND
BENZO(K)FLUORANTHENE	7'00.	J 40.	10000.	10000.
BIS(2-CHLOROETHOXY)METHANE	ND	ND	ND	ND
BIS(2-CHLOROETHYL) ETHER	ND	ND	ND	ND
BIS(2-CHLOROISOPROPYL) ETHER	ND	ND	ND	ND
BIS(2-ETHYLHEXYL) PHTHALATE	NL	1,0	NO	ND
4-BROMOPHENYL PHENYL ETHER	ND	ND	ND	ND
BUTYL BENZYL PHTHALATE	110	ND	ND	,10
2-CHLORONAPHTHALENE	"0	ND	ND	ND
4-CHLOROPHENYL PHENYL ETHER	'10	ND	to	ND
CHRYSENE	36000.	320.	20000.	11000.
DIBENZO(A,H)ANTHRACENE	5000.	ND	NO	ND
1,2-DICHLOROBENZENE	,10	ND	ND	ND
1,3-DICHLOROBENZENE	ND	ND	ND	NO
1,4-DICHLOROBENZENE	ND	ND	NO	NO
3,3'-DICHLOROBENZIDINE	NO	ND	NO	ND
DIETHYL PHTHALATE	I'D	ND	ND	ND
DIMETHYL PHTHALATE	NO	ND	"D	ND
DI-N-BUTYL PHTHALATE	ND	LU	NU	ND
2,4-DINITROTOLUENE	110	ND	ND	ND
2,6-DINITROTOLUENE	NO	1.0	NO	110
DI-N-OCTYL PHTHALATE	ND	ND	NO	ND
1,2-DIPHENYLHYDRAZINE	ND	I,n	ItO	ND
FLUORANTHENE	120000.	2000.	410000.	260000.
FLUORENE	64000.	340.	110000.	UOOOO.
HEXACHLOROBENZENE	NO	ND	NO	ND
HEXACHLOROBUTADIENE	ND	ND	ND	ND
HEXACHLOROCYCLOPENTADIENE	ND	ND	No	ND
HEXACHLOROETHANE	NO	ND	110	ND
INDENO(1,2,3-C,D)PYRENE	2200.	1.0	ND	ND
ISOPHORONE	ND	ND	NO	tID
NAPHTHALENE	100000.	ND	610000.	340000.
NITROBENZENE	ND	ND	ND	ND
N-NITROSODIMETHYLAMINE	ND	ND	ND	ND
N-NITROSODI-N-PROPYLAMINE	ND	ND	ND	ND
N-NITROSODIPHENYLAMINE	ND	ND	ND	ND
PHENANTHRENE	100000.	1400.	1100000.	240000.
PYRENE	88000.	1400.	200000.	170000.
1,2,4-TRICHLOROBENZENE	ND	110	ND	ND

WATER/SOIL QUALITY DATA

ALL RESULTS FOR THIS PAGE ARE FOR LOCATION SL-05

	FEB-02-1983	FEB-02-1983	FEB-02-1983
SAMPLER:	HEAD	HEAD	HEAD
SAMPLE NO.:	SL0501	SL0502	SL0503
SAMPLE SOURCE:	SL	SL	SL

HIGH NEUTRALS UNITS: PPB

ACENAPHTHENE	40	ND
ACENAPHTHYLENE	40	ND
ANTHRACENE	5000.	ND
BENZIDINE	40	ND
BENZO(A)ANTHRACENE	17000.	ND
BENZO(A)PYRENE	11000.	110
3,4-BENZOFLUORANTHENE	25000.	240.
BENZO(G,H,I)PERYLENE	ND	ND
BENZO(K)FLUORANTHENE	25000.	240.
BIS(2-CHLOROETHOXY)METHANE	40	ND
BIS(2-CHLOROETHYL) ETHER	ND	ND
BIS(2-CHLOROISOPROPYL) ETHER	ND	ND
BIS(2-ETHYLHEXYL) PHTHALATE	1600.	NO
4-BROMOPHENYL PHENYL ETHER	ND	40
BUTYL BENZYL PHTHALATE	ND	ND
2-CHLORONAPHTHALENE	ND	40
4-CHLOROPHENYL PHENYL ETHER	400	ND
CHRYSENE	17000.	40
DIBENZO(A,H) ANTHRACENE	1000.	ND
1,2-DICHLOROBENZENE	ND	ND
1,3-DICHLOROBENZENE	40	ND
1,4-DICHLOROBENZENE	40	ND
3,3'-DICHLOROBENZIDINE	ND	ND
DIETHYL PHTHALATE	40	ND
DIMETHYL PHTHALATE	400	NV
DI-N-BUTYL PHTHALATE	400.	110
2,4-DINITROTOLUENE	ND	ND
2,6-DINITROTOLUENE	ND	ND
DI-N-OCTYL PHTHALATE	420.	ND
1,2-DIPHENYLHYDRAZINE	ND	ND
FLUORANTHENE	9300.	ND
FLUORENE	240.	ND
HEXACHLOROBENZENE	ND	ND
HEXACHLOROBUTADIENE	ND	ND
HEXACHLOROCYCLOPENTADIENE	NV	ND
HEXACHLOROETHANE	ND	NV
INDENO(1,2,3-C,D)PYRENE	ND	ND
ISOPHORONE	40	NO
NAPHTHALENE	ND	ND
NITROBENZENE	ND	>U
N-NITROSODIMETHYLAMINE	ND	ND
N-NITROSODI-N-PROPYLAMINE	ND	ND
N-NITROSODIPHENYLAMINE	ND	ND
PHENANTHRENE	ND	ND
PYRENE	40	NO
1,2,4-TRICHLOROBENZENE	110000.	ND

000223

WATER/SOIL QUALITY DATA

ALL RESULTS FOR THIS PAGE ARE FOR LOCATION SL-05

	FEB-02-1983	FEB-02-1983	FEB-02-1983
SAMPLER:	HEAD	HEAD	HEAD
SAMPLE NO.:	SL0501	SL0504	SL0505
SAMPLE SOURCE:	SL	SL	SL

BASE NEUTRALS UNITS: PPB

ACENAPHTHENE	ND	22000.	ND
ACENAPHTHYLENE	ND	350.	ND
ANTHRACENE	9000.	ND	ND
BENZIDINE	ND	ND	ND
BENZO(A)ANTHRACENE	17000.	2400.	ND
BENZO(A)PYRENE	11000.	ND	ND
3,4-BENZOFLUORANTHENE	25000.	2200.	ND
BENZO(G,H,I)PERYLENE	ND	ND	ND
BENZO(K)FLUORANTHENE	25000.	2200.	ND
BIS(2-CHLOROETHOXY)METHANE	ND	ND	ND
BIS(2-CHLOROETHYL) ETHER	ND	ND	ND
BIS(2-CHLOROISOPROPYL) ETHER	ND	ND	ND
BIS(2-ETHYLHEXYL) PHTHALATE	310.	ND	ND
4-BROMOPHENYL PHENYL ETHER	ND	ND	ND
BUTYL BENZYL PHTHALATE	ND	ND	ND
2-CHLORONAPHTHALENE	ND	ND	ND
4-CHLOROPHENYL PHENYL ETHER	ND	ND	ND
CHRYSENE	11000.	1700.	ND
DIBENZO(A,H)ANTHRACENE	3000.	ND	ND
1,2-DICHLOROBENZENE	ND	ND	ND
1,3-DICHLOROBENZENE	ND	ND	ND
1,4-DICHLOROBENZENE	ND	ND	ND
3,3'-DICHLOROBENZIDINE	ND	ND	ND
DIETHYL PHTHALATE	ND	ND	ND
DIMETHYL PHTHALATE	ND	ND	ND
DI-N-BUTYL PHTHALATE	100.	14000.	ND
2,4-DINITROTOLUENE	ND	ND	ND
2,6-DINITROTOLUENE	ND	ND	ND
DI-N-OCTYL PHTHALATE	410.	ND	ND
1,2-DIPHENYLHYDRAZINE	ND	ND	ND
FLUORANTHENE	9100.	24000.	ND
FLUORENE	240.	1000.	ND
HEXACHLOROBENZENE	ND	ND	ND
HEXACHLOROBUTADIENE	ND	ND	ND
HEXACHLOROCYCLOPENTADIENE	ND	ND	ND
HEXACHLOROETHANE	ND	ND	ND
INDENO(1,2,3-c,d)PYRENE	ND	1.0	ND
ISOPHORONE	ND	1.0	ND
NAPHTHALENE	ND	30000.	ND
NITROBENZENE	110	1.0	ND
N-NITROSODIMETHYLAMINE	ND	ND	ND
N-NITROSODI-N-PROPYLAMINE	ND	ND	ND
N-NITROSODIPHENYLAMINE	ND	ND	ND
PHENANTHRENE	ND	54000.	ND
PYRENE	ND	18000.	ND
1,2,4-TRICHLOROBENZENE	110000.	ND	ND

000224

WATER/SOIL QUALITY DATA

	SL-06	SL-06	SL-07
	FEB-01-1983	FEB-01-1983	FEB-01-1983
SAMPLER:	MEAD	MEAD	MEAD
SAMPLE NO.:	SL0605	SL0604	SL0703
SAMPLE SOURCE:	SL	SL	SL

BASE NEUTRALS UNITS: PPB

ACENAPHTHENE	ND	17000.	16000.
ACENAPHTHYLENE	ND	ND	ND
ANTHRACENE	ND	ND	ND
BENZIDINE	ND	110	ND
BENZO(A)ANTHRACENE	ND	tOOO.	8600.
BENZO(A)PYRENE	ND	t,O	2200.
3,4-BENZOFLUORANTHENE	ND	ND	8600.
BENZO(G,H,I)PERYLENE	ND	ND	ND
BENZO(K)FLUORANTHENE	ND	ND	8600.
BIS(2-CHLOROETHOXY)METHANE	ND	I,D	ND
BIS(2-CHLOROETHYL) ETHER	ND	ND	NO
BIS(2-CHLOROISOPROPYL) ETHER	ND	NO	ND
BIS(2-ETHYLHEXYL) PHTHALATE	ND	ND	NO
4-BROMOPHENYL PHENYL ETHER	ND	ND	NO
BUTYL BENZYL PHTHALATE	ND	I,D	NO
2-CHLORONAPHTHALENE	ND	ND	ND
4-CHLOROPHENYL PHENYL ETHER	ND	ND	NU
CHRYSENE	ND	t,O	7900.
DIBENZO(A,H)ANTHRACENE	'O	ND	ND
3,2-DICHLOROBENZENE	ND	ND	ND
1,3-DICHLOROBENZENE	'10	"O	NO
1,4-DICHLOROBENZENE	ND	ND	NO
3,3'-DICHLOROBENZIDINE	ND	t,O	ND
DIETHYL PHTHALATE	dO	ND	NO
DIMETHYL PHTHALATE	'10	t,U	ND
DI-N-BUTYL PHTHALATE	ND	ND	ND
2,4-DINITROTOLUENE	ND	ND	ND
2,6-DINITROTOLUENE	IIU	1,0	NO
DI-N-OCTYL PHTHALATE	ND	ND	ND
1,2-DIPHENYLHYDRAZINE	ND	ND	ND
FLUORANTHENE	ND	40000.	110000.
FLUORENE	ND	1100U.	16000.
HEXACHLOROBENZENE	ND	ND	ND
HEXACHLOROBUTADIENE	ND	ND	ND
HEXACHLOROCYCLOPENTADIENE	ND	ND	ND
HEXACHLOROETHANE	ND	ND	NU
Indeno(1,2,3-C,D)PYRENE	ND	ND	110
ISOPHORONE	ND	1,0	'O
NAPHTHALENE	NO	27000.	33000.
NITROBENZENE	ND	f,O	ND
N-NITROSODIMETHYLAMINE	ND	110	110
N-NITROSODI-N-PROPYLAMINE	ND	ND	ND
N-NITROSODIPHENYLAMINE	ND	I,U	ND
PHENANTHRENE	NO	96000.	5400 O.
PYRENE	'10	21000.	44000.
1,2,4-TRICHLOROBENZENE	NO	ND	ND

WATER/SOIL QUALITY DATA

	SW-01	SW-02
	FEB-02-1981	FEB-02-1983
SAMPLER:	MEAD	MEAD
SAMPLE NO.:	5'/0112	SW0212
SAMPLE SOURCE:	SW	SW

BASE NEUTRALS UNITS: PPB

ACENAPHTHENE	ND	ND
ACENAPHTHYLENE	ND	ND
ANTHRACENE	NO	ND
BENZIDINE	ND	ND
BENZO(A)ANTHRACENE	ND	10.
BENZO(A)PYRENE	ND	10.
3,4-BENZOFLUORANTHENE	ND	11.
BENZO(C,H,I)PERYLENE	ND	ND
BENZO(K)FLUORANTHENE	ND	21.
BIS(2-CHLOROETHOXY)METHANE	ND	ND
BIS(2-CHLOROETHYL) ETHER	ND	ND
BIS(2-CHLOROISOPROPYL) ETHER	ND	ND
BIS(2-ETHYLHEXYL) PHTHALATE	ND	ND
4-BROMOPHENYL PHENYL ETHER	NO	ND
BUTYL BENZYL PHTHALATE	ND	ND
2-CHLORONAPHTHALENE	ND	ND
4-CHLOROPHENYL PHENYL ETHER	NO	ND
CHRYSENE	ND	12.
DIBENZO(A,H)ANTHRACENE	ND	ND
1,2-DICHLOROBENZENE	ND	ND
1,3-DICHLOROBENZENE	ND	ND
1,4-DICHLOROBENZENE	ND	ND
3,3'-DICHLOROBENZIDINE	ND	ND
DIETHYL PHTHALATE	ND	ND
DIMETHYL PHTHALATE	ND	ND
DI-N-BUTYL PHTHALATE	ND	ND
1,3-DINITROBENZENE	ND	ND
2,6-DINITROTOLUENE	ND	ND
DI-N-OCTYL PHTHALATE	ND	ND
1,2-DIPHENYLHYDRAZINE	ND	ND
FLUORANTHENE	ND	ND
FLUORENE	ND	ND
HEXACHLOROBENZENE	ND	ND
HEXACHLOROBUTADIENE	ND	ND
HEXACHLOROCYCLOPENTADIENE	ND	ND
HEXACHLOROETHANE	ND	ND
INDENO(1,2,3-C,D)PYRENE	ND	ND
ISOPHORONE	ND	ND
NAPHTHALENE	ND	ND
NITROBENZENE	ND	ND
N-NITROSODIMETHYLAMINE	ND	ND
N-NITROSODI-N-PROPYLAMINE	ND	ND
N-NITROSODIPHENYLAMINE	ND	ND
PHENANTHRENE	ND	ND
PYRENE	ND	ND
1,2,4-TRICHLOROBENZENE	ND	ND

WATER/SOIL QUALITY DATA

	0..-01	U',/-02	0W-03	OW-04	0W-05
	FEB-08-1983	FEB-08-1983	FEB-08-1983	FEB-08-1983	FEB-08-1983
SAMPLER:	HEAD	"EAD	HEAD	HEAD	HEAD
SAMPLE NO.:	0W0105	0W0204	IIW010)	(0W0401	0W0502
SAMPLE SOURCE:	"W	0W	0W	0W	0W

PESTICIDES, PCB'S & DIOXINS UNITS:PPB

ALDRIN	ND	ND	ND	LD	110
ALPHA-BHC	ND	ND	NO	ND	ND
BETA-BHC	ND	ND	NO	110	IIU
GAMMA-BHC	ND	ND	ND	liD	NU
DELTA-BHC	ND	LD	NO	110	ND
CHLORDANE	ND	ND	ND	110	'10
4,4'-DDT	ND	LD	NO	NO	IIO
4,4'-DDE	ND	ND	ND	ND	ND
4,4'-DDD	ND	ND	ND	;IU	,,0
DIELDRIN	ND	ND	NO	ND	1'0
ALPHA-ENDOSULFAN	110	NI	ND	ND	ND
BETA-ENDOSULFAN	-O	110	NO	1:0	ND
ENDOSULFAN SULFATE	ND	ND	ND	ND	ND
ENDRIN	ND	ND	ND	ND	lie
ENDRIN ALDEHYDE	ND	ND	NO	ND	110
HEPTACHLOR	ND	ND	-O	ND	110
HEPTACHLOR EPOXIDE	ND	ND	NO	I/O	NO
PCB-1242	ND	ND	ND	ND	ND
PCB-1254	NO	ND	110	ND	'10
PCB-1221	NO	ND	"0	ND	NO
PCB-1232	ND	ND	NO	ND	NU
PCB-1248	ND	/,0	NO	ND	110
PCB-1260	ND	/,0	NO	ND	IIO
PCB-1016	ND	ND	ND	ND	ND
TOXAPHENE	ND	ND	NO	ND	110
TETRACHLORODIBENZO-P-DIOXIN	ND	ND	ND	ND	

000227

WATER/SOIL QUALITY DATA

ALL RESULTS FOR THIS PAGE ARE FOR LOCATION 04-06

	FEB-08-1983	MAY-11-1983	MAY-11-1983	MAY-26-1983
SAMPLER:	MEAD	CDM	CDM	CDM
SAMPLE NO.:	0W0603	0W0611	0W0619	0W0601
SAMPLE SOURCE:	DW	LY	DW	DW

PESTICIDES, PCB'S & DIOXINS UNITS:PPB

ALDRIN				
ALPHA-BHC	ND	ND	ND	
BETA-BHC	ND	NO	ND	
GAMMA-BHC	ND	ND	ND	
DELTA-BHC	ND	NO	ND	
CHLORDANE	NO	ND	ND	
4,4'-DDT	ND	ND	ND	
4,4'-DDE	ND	NO	ND	
4,4'-DDD	ND	NO	ND	
DIELDRIN	ND	ND	ND	
ENDOSULFAN I	ND	NO	NO	
BETA-ENDOSULFAN	ND	NO	ND	
ENDOSULFAN SULFATE	ND	NO	ND	
ENDRIN	ND	NO	110	
ENDRIN ALDEHYDE	ND	110	NO	
HEPTACHLOR	ND	NO	ND	
HEPTACHLOR EPOXIDE	ND	NO	ND	
PCB-1242	ND	NO	ND	
PCB-1254	ND	ND	ND	
PCB-1221	ND	ND	ND	
PCB-1232	ND	NO	UO	
PCB-1248	ND	NO	ND	
PCB-1260	ND	ND	ND	
PCB-1016	ND	ND	Nil	
TOXAPHENE	ND	NO	ND	
TETRACHLORODIBENZO-P-DIOXIN	ND	ND	ND	

000228

000228

WATER/SOIL QUALITY DATA

	PW-01	PW-02	PW-03	PW-04
SAMPLER:	MEAD	MEAD	MEAD	MEAD
SAMPLE NO.:	PW0101	PW0102	PW03D)	PW04D4
SAMPLE SOURCE:	PW	PW	PW	PW

PESTICIDES, PCB'S & DIOXINS UNITS:PPB

ALDRIN	ND	ND	:10	ND
ALPHA-BHC	ND	ND	ND	ND
BETA-BHC	ND	ND	ND	ND
GAMMA-BHC	ND	ND	ND	ND
DELTA-BHC	ND	ND	ND	ND
CHLORDANE	ND	ND	ND	ND
4,4'-DDT	ND	ND	ND	ND
4,4'-DDE	ND	ND	NO	NO
4,4'-DDD	ND	ND	ND	ND
DIELDRIN	ND	ND	'U	ND
ALPHA-ENDOSULFAN	ND	ND	ND	ND
BETA-ENDOSULFAN	ND	ND	NO	ND
ENDOSULFAN SULFATE	ND	ND	ND	ND
ENDRIN	ND	ND	ND	ND
ENDRIN ALDEHYDE	'IL	ND	NO	ND
HEPTACHLOR	ND	ND	ND	ND
HEPTACHLOR EPOXIDE	ND	ND	"0	ND
PCB-1242	ND	ND	ND	ND
PCB-1254	ND	ND	NO	ND
PCB-1221	ND	ND	ND	ND
PCB-1232	ND	ND	NO	ND
PCB-1248	ND	ND	ND	ND
PCB-1260	ND	ND	NO	ND
rCO-IOI.	ND	ND	NO	ND
TOXAPHENE	ND	ND	ND	ND
TETRACHLORODIBENZO-P-DIOXIN				

000229

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WATER/SOIL QUALITY DATA

	SD-01	SD-02	
	FEB-02-1983	FEB-01-1983	*****
SAMPLER:	HEAD	HEAD	
SAMPLE NO.:	SD0109	SL0207	
SAMPLE SOURCE:	SD	SD	

PESTICIDES, PCB'S & DIOXINS UNITS:PPB

ALDRIN	ND	ND
ALPHA-BHC	ND	ND
BETA-BHC	ND	ND
GAMMA-BHC	ND	ND
DELTA-BHC	ND	ND
CHLORDANE	ND	ND
4,4'-DDT	ND	ND
4,4'-DDE	ND	ND
4,4'-DDD	ND	ND
DIELDRIN	ND	ND
ALPHA-ENDOSULFAN	ND	ND
BETA-ENDOSULFAN	ND	ND
ENDOSULFAN SULFATE	ND	ND
ENDRIN	ND	ND
ENDRIN ALDEHYDE	ND	ND
HEPTACHLOR	ND	ND
HEPTACHLOR EPOXIDE	ND	ND
PCB-1242	ND	ND
PCB-1254	ND	ND
PCB-1221	ND	ND
PCB-1232	ND	ND
PCB-1248	ND	ND
PCB-1260	ND	ND
PCB-1016	ND	ND
TOXAPHENE	ND	ND
TETRACHLORODIBENZO-P-DIOXIN	ND	ND

000230

DRAFT **** CAVALCADE YARD SITE **** DRAFT ****

JUL-07-1983
08:38

WATER/SOIL QUALITY DATA

	SO-OJ	SO-04	SU-05
	FEB-02-1983	FEB-02-1983	FEB-01-1983
SAMPLER:	HEAD	HEAD	HEAD
SAMPLE NO.:	5001(0	50041	500506
SAMPLE SOURCE:	SO	SO	SO
PESTICIDES, PCB'S & DIOXINS UNITS:PPB			
ALDRIN			
ALPHA-BHC	ND	ND	ND
BETA-BHC	ND	ND	ND
GAMMA-BHC	ND	ND	ND
DELTA-BHC	ND	ND	ND
CHLORDANE	ND	ND	110
4,4'-DDT	ND	ND	ND
4,4'-DDE	ND	ND	ND
4,4'-DDD	ND	ND	ND
DIELDRIN	ND	ND	ND
ALPHA-ENDOSULFAN	ND	ND	ND
BETA-ENDOSULFAN		ND	ND
ENDOSULFAN SULFATE	ND	ND	NO
ENDRIN	ND	fit)	NO
ENDRIN ALDEHYDE	ND	ND	ND
HEPTACHLOR	ND	ND	tiD
HEPTACHLOR EPOXIDE	ND	ND	NO
PCB-1242	ND	I.D	NO
PCB-1254	ND	I.D	ND
PCB-1221	ND	ND	NO
PCB-1232	ND	ND	'<0
PCB-1248	ND	ND	ND
PCB-1260	110	ND	NO
PCB-1016		ND	NO
TOXAPHENE	ND	I.D	NO
TETRACHLORODIBENZO-P-DIOXIN	ND	I,n	NO
	ND	1.0	ND

000231

000231

WATER/SOIL QUALITY DATA

	SL-01	SL-02	SL-01	SL-03	SL-01
	FEB-01-1983	FEB-01-1983	FEB-03-1983	FEB-03-1983	FEB-03-1983
SAMPLER:	MEAD	MEAD	MEAD	MEAD	MEAD
SAMPLE NO.:	SL0101	SL0202	SL0302	SL0303	SL0301
SAMPLE SOURCE:	SL	SL	SL	SL	SL

PESTICIDES, PCB'S & EPOXIDES UNITS:PPB

ALDRIN	UD	ND	ND	ND	ND
ALPHA-BHC	UD	ND	ND	ND	ND
BETA-BHC	ND	ND	ND	ND	ND
GAMMA-BHC	ND	ND	ND	ND	ND
DELTA-BHC	ND	ND	ND	110	ND
CHLORDANE	ND	ND	ND	ND	ND
4,4'-DDT	ND	ND	ND	UO	ND
4,4'-DDE	ND	ND	ND	ND	ND
4,4'-DDD	ND	ND	ND	110	ND
DIELDRIN	ND	110	ND	ND	ND
ALPHA-ENDOSULFAN	ND	ND	ND	ND	110
BETA-ENDOSULFAN	ND	ND	ND	ND	ND
ENDOSULFAN SULFATE	ND	ND	ND	ND	ND
ENDRIN	ND	ND	ND	110	ND
ENDRIN ALDEHYDE	ND	ND	ND	ND	ND
HEPTACHLOR	ND	ND	ND	ND	110
HEPTACHLOR EPOXIDE	ND	ND	ND	110	ND
PCB-1242	ND	ND	ND	110	110
PCB-1254	ND	ND	UO	ND	ND
PCB-1221	ND	ND	ND	ND	110
PCB-1232	ND	ND	ND	110	ND
PCB-1248	ND	ND	ND	110	110
PCB-1260	ND	ND	ND	110	ND
PCB-1016	ND	ND	ND	ND	ND
TOXAPHENE	UD	ND	ND	1,0	ND
TETRACHLOR,CDIBENZO-P-DIOXIN	UD	ND	ND	ND	ND

000232

000232

WATER/SOIL QUALITY DATA

ALL RESULTS FOR fillS PAGE ARE FOR LOCATION SI-04

SAMPLER:	FEB-04-1981 HEAD	FEB-04-1983 HEAD	FEB-04-1983 HEAD	FEB-04-1983 HEAD
SAMPLE NO.:	SL0403	SL 010'1	SL0402	SL0401
SAMPLE SOURCE:	SL	SL	SL	SL
PESTICIDES, PCB'S & DIOXINS	UNITS:PPB			
ALDRIN	NO	ND	110	ND
ALPHA-BHC	ND	1,,1	ND	t,n
BETA-BHC	ND	ND	NO	110
GAMMA-BHC	ND	ND	ND	ND
DELTA-BHC	ND	ND	ND	ND
CHLORDANE	ND	ND	ND	ND
4,4'-DDT	ND	ND	ND	I/O
4,4'-DDE	ND	t.O	110	ND
4,4'-DDD	ND	ND	ND	1,0
DIELDRIN	7t.	ND	!ID	ND
ALPHA-ENDOSULFAN	ND	ND	ND	ND
BETA-ENDOSULFAN	ND	ND	!10	ND
ENDOSULFAN SULFATE	ND	ND	ND	ND
ENDRIN	'/O	ND	ND	ND
ENDRIN ALDEHYDE	ND	ND	ND	ND
HEPTACHLOR	ND	ND	ND	/,n
HEPTACHLOR EPOXIDE	'to	ND	ND	ND
PCB-1242	ND	ND	"0	liD
PCB-1254	'to	1.0	ND	ND
PCB-1221	'III	ND	ND	ND
PCB-1232	ND	ND	ND	ND
PCB-1248	ND	ND	"0	ND
PCB-1260	ND	ND	NO	ND
PCB-1016	ND	t.O	ND	ND
TOXAPHENE	ND	ND	ND	ND
TETRACHLORODIBENZO-P-DIOXIN	'10	ND	ND	ND
	ND	ND	ND	ND

000233

000233

ALL RESULTS FOR THIS PAGE ARE FOR LOCATION SL-05

	FEB-02-1983	FEB-02-1983	FEB-02-1983
SAMPLER:	MEAD	MEAD	MEAD
SAMPLE NO.:	SL0501	SL0502	SL0503
SAMPLE SOURCE:	SL	SL	SL
PESTICIDES, PCB'S & DIOXINS	UNITS:PPB		
ALDRIN			
ALPHA-BHC	ND		ND
BETA-BHC	ND		ND
GAMMA-BHC	ND		ND
DELTA-BHC	ND		ND
CHLORDANE	ND		ND
4,4'-DDT	ND		ND
4,4'-DDE	ND		ND
4,4'-DDD	ND		ND
DIELDRIN	ND		ND
ALPHA-ENDOSULFAN	ND		ND
BETA-ENDOSULFAN	ND		ND
ENDOSULFAN SULFATE	ND		ND
ENDRIN	ND		ND
ENDRIN ALDEHYDE	ND		ND
HEPTACHLOR	ND		ND
HEPTACHLOR EPOXIDE	ND		ND
PCB-1242	ND		110
PCB-1254	ND		ND
PCB-1221	ND		ND
PCB-1232	ND		NO
PCB-1248	ND		NO
PCB-1260	NV		NO
PCB-1016	2300.		ND
TOXAPHENE	ND		ND
TETRACHLORODIBENZO-P-DIOXIN	ID		ND
	ND		NO
			ND

NOTE -- ENVO. PCR LOCATION SL-05

IS CONTINUED ON NEXT PAGE.

000234

CAVALCADE YARD SITE

WATER/SOIL QUALITY DATA

JUL-07-1983
08:18

ALL RESULTS FOR THIS PAGE ARE fOR LOCATION SL-05

SAMPLED:	FEB-02-1983	FEB-02-1983	FEB-02-1983
SAMPLE NO.:	SL0503	SL0504	SL0505
SAMPLE SOURCE:	SL	SL	SL

PESTICIDES, PCB'S & DIOXINS — UNITS: PPB

ALDRIN	ND	ND	ND
ALPHA-BHC	ND	ND	NO
BETA-BHC	ND	ND	ND
GAMMA-BHC	ND	ND	ND
DELTA-BHC	ND	ND	ND
CHLORDANE	ND	ND	ND
4,4'-DDT	ND	ND	110
4,4'-DDE	ND	ND	ND
4,4'-DDD	ND	ND	ND
DIELDRIN	ND	ND	ND
ALPHA-ENDOSULFAN	ND	ND	ND
BETA-ENDOSULFAN	ND	ND	ND
ENDOSULFAN SULFATE	ND	ND	ND
ENDRIN	ND	ND	ND
ENDRIN ALDEHYDE	ND	ND	ND
HEPTACHLOR	ND	ND	NO
HEPTACHLOR EPOXIDE	ND	ND	NO
PCB-1242	ND	ND	NO
PCB-1254	ND	ND	NO
PCB-1221	ND	ND	NO
PCB-1232	ND	ND	NO
PCB-1248	ND	ND	NO
PCB-1260	ND	ND	NO
PCB-1016	2.100	1,0	NO
TEXAPHENE	ND	ND	NO
TETRACHLORODIBENZO-P-DIOXIN	ND	ND	NO

000235

000235

WATER/SOIL QUALITY DATA

	SL-06	SL-06	SL-07
	FEB-01-1983	FEB-01-1983	FEB-01-1983
SAMPLER:	HEAD	HEAD	HEAD
SAMPLE NO.:	SL0605	SL0604	SL0703
SAMPLE SOURCE:	SL	SL	SL
PESTICIDES, PCB'S & DIOXINS	UNITS:PPB		
ALDRIN	ND	ND	ND
ALPHA-BHC	ND	ND	ND
BETA-BHC	ND	ND	ND
GAMMA-BHC	ND	ND	ND
DELTA-BHC	ND	ND	ND
CHLORDANE	ND	ND	ND
4,4'-DDT	ND	ND	ND
4,4'-DDE	ND	ND	ND
4,4'-DDD	ND	ND	ND
DIELDRIN	ND	ND	ND
ALPHA-ENDOSULFAN	ND	ND	ND
BETA-ENDOSULFAN	ND	ND	ND
ENDOSULFAN SULFATE	ND	ND	ND
ENDRIN	ND	ND	ND
ENDRIN ALDEHYDE	ND	ND	ND
HEPTACHLOR	ND	ND	ND
HEPTACHLOR EPOXIDE	ND	ND	ND
PCB-1242	ND	ND	ND
PCB-1254	ND	ND	ND
PCB-1221	ND	ND	ND
PCB-1232	ND	ND	ND
PCB-1248	ND	ND	ND
PCB-1260	ND	ND	ND
PCB-1016	ND	ND	ND
TOXAPHENE	ND	ND	ND
TETRACHLORODIBENZO-P-DIOX[illegible] 1/	ND	ND	ND

000236

000236

WATER/SOIL QUALITY DATA

	SW-01	SW-02
	FEB-02-1983	FEB-02-1983
SAMPLER:	MEAD	MEAD
SAMPLE NO.:	SW0112	SW0212
SAMPLE SOURCE:	SW	SW

PESTICIDES, PCB'S & DIOXINS UNITS:PPB

ALDRIN	ND	ND
ALPHA-BHC	ND	ND
BETA-BHC	ND	1.0
GAMMA-BHC	ND	ND
DELTA-BHC	ND	ND
CHLORDANE	ND	ND
4,4'-DDT	ND	ND
4,4'-DDE	ND	1.0
4,4'-DDD	ND	ND
DIELDRIN	ND	ND
ALPHA-ENDOSULFAN	ND	ND
BETA-ENDOSULFAN	ND	ND
ENDOSULFAN SULFATE	ND	ND
ENDRIN	ND	ND
ENDRIN ALDEHYDE	NL	ND
HEPTACHLOR	ND	ND
HEPTACHLOR EPOXIDE	ND	ND
PCB-1242	ND	ND
PCB-1254	ND	1.0
PCB-1221	ND	ND
PCB-1232	ND	ND
PCB-1248	ND	ND
PCB-1260	ND	ND
pcr'-folb	ND	ND
TOXAPHENE	ND	1.0
TETRACHLORODIBENZO-P-DIOXIN	ND	ND

000237

WATER/SOIL QUALITY DATA

	GW-01	GW-02	GW-01	GW-04	GW-05
	FEB-08-1983	FEB-09-1983	FEB-08-1983	FEB-08-1983	FEB-08-1983
SAMPLE:	LEAD	LEAD	LEAD	LEAD	LEAD
SAMPLE NBR.:	GW0105	GW0204	GW0303	GW0401	GW0502
SAMPLE SOURCE:	GW	GW	GW	GW	GW

METALS/INORGANICS UNITS: PPM

ANTIMONY	tiL	1;0	ND	ND	ND
ARSENIC	"0	.1J0	ND	.050	ND
BERYLLIUM	ND	ND	ND	ND	ND
CADMIUM	ND	ND	.010	ND	.020
CHROMIUM	ND	ND	ND	ND	ND
COPPER	.060	ND	NO	ND	.050
LEAD	ND	ND	ND	ND	ND
MERCURY	ND	ND	NO	ND	ND
NICKEL	ND	ND	ND	ND	ND
SELENIUM	ND	ND	NO	ND	ND
SILVER	ND	ND	ND	ND	ND
THALLIUM	ND	ND	"0	ND	ND
ZINC	.120	.200	.450	.150	ND
TOTAL CYANIDES	.700	.010	.010	.050	ND

000238

WATER/SOIL QUALITY DATA

OB: 38

ALL RESULTS FOR THIS PAGE ARE FOR LOCATION OW-06

	FEB-08-1983	MAY-11-1983	MAY-11-1983	MAY-26-1983
SAMPLER:	MSAU	CDM	CDM	CDM
SAMPLE NO.:	OW0603	OW0611	OW0619	OW0601
SAMPLE SOURCE:	OW	OW	OW	OW
METALS/INORGANICS UNITS: PPM				
ANTIMONY		LD	ND	.100
ARSENIC		12.000	12.000	.050
BERYLLIUM		.100	.31a	ND
CADMIUM		.100	.310	tiD
CHROMIUM		17.000	2.400	ND
COPPER		.600	1.000	ND
LEAD		5.700	7.500	ND
MERCURY		.003	ND	ND
NICKEL		.500	4.600	ND
SELENIUM		ND	NO	NU
SILVER		6.9	ND	.260
THALLIUM		2.100	I.900	ND
ZINC		I.100	7.300	ND
TOTAL CYANIDES		1.0	ND	1m

000239

	PW-01	PW-02	PW-03	PW-04
SAMPLE#:	FEB-23-1983	FEB-23-1983	FEB-23-1983	FEB-23-1983
SAMPLE NO.:	LEAD	LEAD	LEAD	LEAD
SAMPLE SOURCE:	PW0101	PW0202	PW0101	PW0404
	PW	PW	PW	PW
METALS/INORGANICS UNITS: PPM				
ANTIMONY				
ARSENIC	ND	ND	NO	
BERYLLIUM	ND	ND	ND	
CADMIUM	10	.n	ND	
CHROMIUM	ND	.040	110	
COPPER	ND	ND	ND	
LEAD	ND	.0	.0	
MERCURY	.150	.150	.100	
NICKEL	ND	ND	ND	
SELENIUM	ND	ND	ND	
SILVER	"0	ND	ND	
THALLIUM	/D	ND	ND	
ZINC	ND	.01	ND	
TOTAL CYANIDES	.580	.520	.200	
	'le	ND	ND	

000240

000240

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WATER/SOIL QUALITY DATA

	SD-01	SD-02
	FEB-02-1983	FEB-01-1983
SAMPLE%:	#SAD	#ERD
SAMPLE NO.:	S00100	S00207
SAMPLE SOURCE:	SD	SD

METALS/INORGANICS UNITS: PPM

ANTIMONY	ND	ND
ARSENIC	2.000	2.100
BERYLLIUM	.200	.550
CADMIUM	.800	.640
CHROMIUM	10.000	13.000
COPPER	11.000	60.000
LEAD	61.000	87.000
MERCURY	.025	.043
NICKEL	4.500	4.900
SELENIUM	ND	ND
SILVER	.400	.540
THALLIUM	ND	.960
ZINC	160.000	150.000
TOTAL CYANIDES	ND	ND

000241

000241

WATER/SOIL QUALITY DATA

	SO-OJ	SD-04	SD-05
SAMPLED:	FEB-02-1983	FEB-02-1993	nO-Ol-1991
SAMPLE NO.:	HEAD	HEAD	HEAD
SAMPLE SOURCE:	SOOHO	SD0411	SD0506
	SD	SD	SO
METALS/INORGI'rI"S UNITS: PPM			
ANTIMONY			
ARSENIC	ND	1.0	ND
BERYLLIUM	1.500	2.200	1.500
CADMIUM	.290	.480	.190
CHROMIUM	.970	1.100	ND
COPPER	12.000	9.700	6.800
LEAD	21.000	82.000	21.000
MERCURY	69.000	105.000	20.000
NICKEL	.032	.017	.006
SELENIUM	5.100	9.110	4.700
SILVER	ND	ND	ND
THALLIUM	'10	.580	NO
ZINC	.970	1.0	NO
TOTAL CYANIDES	150.000	260.000	10.000
	ND	ND	NO

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WATER/SOIL QUALITY DATA

	SL-01	SL-02	SL-0J	SL-03	SL-03
	FEB-01-1993	FEB-01-1993	FEB-03-1993	FEB-03-1993	FEB-03-1993
SAMPLED:	MEAD	MEAD	MEAD	MEAD	MEAD
SAMPLE NO.:	SL0101	SL0202	SL0J02	SL0303	SL0)0I
SAMPLE SOURCE:	SL	SL	SL	SL	SL

METALS/INORGANICS UNITS: PPM

ANTIMONY	ND	ND	ND	ND	ND
ARSENIC	.353	2..00	1..500	.330	"2.000
BERYLLIUM	.290	ND	.200	.200	.200
CADMIUM	•880	1.0	ND	ND	.100
CHROMIUM	12.000	7.500	\'1.000	3.100	79.000
COPPER	4.400	32.000	1.900	I. JOO	21.000
LEAD	8.400	J1.00n	7.200	7.200	54.000
MERCURY	.005	.009	.062	.009	.040
NICKEL	u..600	31.000	J.000	2.100	2.700
SELENIUM	ND	ND	"0	1.0	ND
SILVER	.700	ND	tO	•880	.200
THALLIUM	ND	ND	NO	ND	.100
ZJ,e	14.000	40.000	23.000	1.600	290.000
TOTAL CYANIDES	ND	ND	NC	ND	'In

000243

WATER SOIL QUALITY DATA

ALL RESULTS FOR THIS PAGE ARE FOR LOCATION SL-04

SAMPLER:	MEAD	MEAD	MEAD	MEAD
SAMPLE NO.:	SL0403	SL0404	SL0402	SL0401
SAMPLE SOURCE:	SL	SL	SL	SL
METALS/INORGANICS UNITS:				51.
ANTIMONY				
ARSENIC	"0	ND	ND	ND
BERYLLIUM	1.200	.290	2.a00	1.000
CADMIUM	.600	.110	.280	.260
CHROMIUM	.500	ND	ND	NO
COPPER	9.100	1.700	1.100	14.000
LEAD	1.100	1.200	.560	ND
MERCURY	9.100	6.100	.370	J.400
NICKEL	.004	.005	.005	.020
SELENIUM	15.000	4.500	J.700	2.JOO
SILVER	'10	ND	ND	'10
THALLIUM	1,200	ND	ND	ND
ZINC	ND	ND	ND	ND
TOTAL CYANIDES	21.000	c.900	1J.000	150.000
	ND	ND	ND	ND

000244

WATER/SOIL QUALITY DATA

ALL RESULTS FOR PAGE ARE FOR LOCATION SL-05

	FEB-02-1983	FEB-02-1983	FEB-02-1983
SAMPLED:	HEAD	HEAD	HEAD
SAMPLE NO.:	SL0501	SL0502	SL0503
SAMPLE SOURCE:	SL	SL	SL
METALS/INORGANICS UNITS: PPM			
ANTIMONY	ND	ND	ND
ARSENIC	.940	.400	.250
BERYLLIUM	.200	.240	.660
CADMIUM	1.000	ND	.660
CHROMIUM	5.700	0.700	5.700
COPPER	10.000	.810	5.600
LEAD	41.000	4.000	10.000
MERCURY	.023	.010	.011
NICKEL	4.300	2.500	19.000
SELENIUM	ND	ND	ND
SILVER	1.600	.110	.940
THALLIUM	ND	ND	ND
ZINC	20,000	4.200	22.000
TOTAL CYANIDES	ND	ND	NO

NOTE -- INFO. FOR LOCATION SL-05 IS CONTINUED ON NEXT PAGE.

000245

ALL RESULTS FOR THIS PAGE ARE FOR LOCATION SL-05

SAMPLED:	FEB-02-1983	FEB-02-1983	FEB-02-1983
SAMPLE NO.:	HEAD	HEAD	HEAD
SAMPLE SOURCE:	SL0501	SL0501	SL0505
METALS/INORGANICS	SL	SL	SL
UNITS: PPM			
ANTIMONY			
ARSENIC			
BERYLLIUM			
CADMIUM	.940	ND	ND
CHROMIUM	.200	ND	.420
COPPER	1.000	.310	.710
LEAD	5.700	.410	.610
MERCURY	30.000	4.500	1.100
NICKEL	11.000	3.200	5.100
SELENIUM	.023	5.500	10.000
SILVER	4.300	.007	.007
THALLIUM	ND	3.700	20.000
ZINC	1.600	ND	ND
TOTAL CYANIDES	.120	ND	.910
	20.000	ND	ND
	ND	14.000	25.000
		ND	ND

000246